ARTICLE

Racial and Ethnic Bias in the Diagnosis of Alcohol Use Disorder in Veterans

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Objective: Studies show that racially and ethnically minoritized veterans have a higher prevalence of alcohol use disorder (AUD) than White veterans. The investigators examined whether the relationship between self-reported race and ethnicity and AUD diagnosis remains after adjusting for alcohol consumption, and if so, whether it varies by self-reported alcohol consumption.

Methods: The sample included 700,012 Black, White, and Hispanic veterans enrolled in the Million Veteran Program. Alcohol consumption was defined as an individual's maximum score on the consumption subscale of the Alcohol Use Disorders Identification Test (AUDIT-C), a screen for unhealthy alcohol use. A diagnosis of AUD, the primary outcome, was defined by the presence of relevant ICD-9 or ICD-10 codes in electronic health records. Logistic regression with interactions was used to assess the association between race and ethnicity and AUD as a function of maximum AUDIT-C score.

Results: Black and Hispanic veterans were more likely than White veterans to have an AUD diagnosis despite similar levels of alcohol consumption. The difference was greatest between Black and White men; at all but the lowest and highest levels of alcohol consumption, Black men had 23%–109% greater odds of an AUD diagnosis. The findings were unchanged after adjustment for alcohol consumption, alcohol-related disorders, and other potential confounders.

Conclusions: The large discrepancy in the prevalence of AUD across groups despite a similar distribution of alcohol consumption levels suggests that there is racial and ethnic bias, with Black and Hispanic veterans more likely than White veterans to receive an AUD diagnosis. Efforts are needed to reduce bias in the diagnostic process to address racialized differences in AUD diagnosis.

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Diagnosis is a foundation of clinical decision making and treatment (1). Diagnoses, as clinical labels, can produce lasting stigma and, when inappropriate, can produce lasting damage to the individuals who receive a diagnosis (2). Diagnoses that are stigmatized, such as alcohol use disorder (AUD), can be particularly damaging. Furthermore, misdiagnosis can result in ineffective treatment, inaccurate prognostic assessments, poor outcomes, and distrust of the health care system (3, 4). Factors that influence the diagnosis of behavior-based conditions include medical conditions, varying symptom presentation, the clinician's level of education and experience, the patient's willingness to disclose symptoms, cultural factors, and the application of standardized criteria or assessments (5). A patient's race or ethnicity and ethnic and racial differences between patients and providers can also influence diagnostic decisions through explicit or implicit bias (3, 6, 7), that is, clinicians' conscious or unconscious prejudices or stereotypes (8, 9).

Studies in the Veterans Health Administration of the Department of Veterans Affairs (VA) have shown that the rate of clinically recognized AUD is higher among Black and Hispanic veterans than among White veterans (10). Black veterans are also more likely than White veterans to be identified as needing an intervention (11) and to receive psychosocial interventions (11, 12) but less likely to receive pharmacotherapy for AUD (13). One potential explanation for the observed group disparities is that these groups differ in alcohol consumption patterns (14); alternatively, AUD may be viewed as a biological illness in White patients but as a behavioral disorder or lifestyle choice among Black and Hispanic patients (15). While these studies suggest the presence of racial and ethnic bias in AUD diagnosis and treatment, collateral information upon which to assess bias in the diagnosis of AUD, such as recent or lifetime measures of alcohol consumption, was unavailable.

Here we examined the contribution of self-reported alcohol consumption to the likelihood of receiving an AUD diagnosis among Black, Hispanic, and White veterans. To facilitate the identification of individuals with unhealthy

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alcohol use, beginning in 2007, the VA has routinely screened primary care patients using the consumption subscale of the Alcohol Use Disorders Identification Test (AUDIT-C) (16, 17), comprising the first three items of the 10-item AUDIT (18). We examined the association of AUDIT-C scores with AUD diagnostic codes across the three racial and ethnic groups in a national cohort of more than 700,000 veterans. Importantly, we are examining race and ethnicity in the context of differential racialization; that is, because no biological basis for these groups exists, race and ethnicity are best understood as social constructs and proxies for the experience of racism and discrimination. Specifically, we evaluated the relationship between race and ethnicity and AUD diagnosis adjusting for self-reported alcohol consumption; evaluated whether this relationship, if it exists, varies by consumption levels; and evaluated sociodemographic and clinical correlates of an AUD diagnosis. Analyses were stratified by sex to account for biological differences (19) related to that variable and to examine the intersectionality of race and ethnicity and sex. Based on previous studies that suggest the presence of racial and ethnic bias in diagnosis and treatment within the VA (10–13, 20) and that bias may vary by alcohol consumption level (21), we hypothesized that Black and Hispanic veterans would have a higher frequency of AUD diagnosis than White veterans after adjusting for alcohol consumption and that the frequency of AUD diagnosis among racial and ethnic groups would vary by alcohol consumption level.

METHODS

Study Sample

The sample for this cross-sectional study was drawn from the Million Veteran Program (MVP), a longitudinal cohort study of U.S. veterans (22). Veterans who receive care in the VA and consent to participate in the MVP complete two self-report surveys and provide access to their electronic health records (EHRs). MVP enrollment began in early 2011, and to date, more than 930,000 veterans have been enrolled. We had access to data for 790,091 participants, of whom 739,411 had AUDIT-C scores and race, ethnicity, and sex data available in their EHRs (see Figure S1, a flow diagram of study inclusion, in the online supplement). The primary analysis included 700,012 individuals. The MVP received approval from the Central Veterans Affairs Institutional Review Board and site-specific institutional review boards. The study was conducted following all relevant human subject protections.

Measures

Race and ethnicity. Race and ethnicity are included in our study as socially defined categories that serve as proxies for the experience of internalized, interpersonal, institutional, and structural racism. Race and ethnicity were self-reported in both an MVP survey and the VA EHR; data from the MVP survey were used in this study, but when race and ethnicity data were missing from the MVP survey, we used data from the EHR (23). We focus here on three groups: non-Hispanic Black (Black), non-Hispanic White (White), and Hispanic. Self-identified Hispanic individuals were classified as Hispanic irrespective of race (24). Analyses of other racial and ethnic groups (including multiracial individuals) are presented in the supplemental material (see Table S1A,B and Figure S2A,B in the online supplement).

Self-reported alcohol consumption. The AUDIT-C is a valid, reliable screening instrument routinely used to identify individuals with unhealthy alcohol use (17). It comprises the first three items of the 10-item AUDIT (18) and measures past-year alcohol consumption. The AUDIT-C includes the following questions and response options. "How often do you have a drink containing alcohol?" Drinking frequency response options include never, monthly or less, two to four times a month, two to three times a week, and four or more times a week. "How many standard drinks containing alcohol do you have on a typical day?" Drinking quantity response options include one or two, three or four, five or six, seven to nine, and 10 or more. "How often do you have six or more drinks on one occasion?" Heavy episodic drinking frequency response options include never, less than monthly, monthly, weekly, and daily or almost daily. The responses to each question are scored from 0 to 4 points and summed for a total AUDIT-C score of 0 to 12 points. AUDIT-C scores $\geq$3 for women and $\geq$4 for men reflect unhealthy alcohol use (17) and call for further assessment. When used to identify individuals with current alcohol abuse or dependence, based on DSM-IV criteria, AUDIT-C scores at these cutoffs had a sensitivity and specificity of 0.79 and 0.56 among men (16) and 0.80 and 0.87 among women (25). When used to identify individuals with AUD or unhealthy alcohol use, AUDIT-C scores at those cutoffs had a sensitivity and specificity of 0.67 and 0.92 among African American women, 0.70 and 0.91 among White women, 0.85 and 0.88 among Hispanic women, 0.76 and 0.93 among African American men, 0.95 and 0.89 among White men, and 0.85 and 0.84 among Hispanic men (26).

For maximal reported alcohol consumption, we extracted the highest AUDIT-C score recorded in participants' VA EHRs, restricting the AUDIT-C observations to those from October 1, 2007, when AUDIT-C screening began in the VA, to September 30, 2019, the latest available data at the time of analysis. In sensitivity analyses, we used age-adjusted mean AUDIT-C scores, with age 50 as the reference point, and we upweighted AUDIT-C scores for individuals older than 50 and downweighted scores for those younger than 50. Each AUDIT-C score was multiplied by the weight corresponding to age at the time of the AUDIT-C assessment, and weighted AUDIT-C scores were summed and divided by the weights for each individual (27).

Heavy episodic drinking, the frequency of which was assessed by AUDIT-C item 3, is particularly harmful and indicative of greater vulnerability to AUD (28). To evaluate whether the relationship between race and ethnicity and AUD diagnosis was influenced by heavy episodic drinking frequency, in addition to overall unhealthy alcohol use

TABLE 1. Demographic and clinical characteristics of the veterans participating in the Million Veteran Program, stratified by sex and race and ethnicity (N=700,012)

Characteristic	Black		Hispanic		White		p
Men							
	N	%	N	%	N	%	
Total sample (N=638,204)	118,600	18.6	45,330	7.1	474,274	74.3	
	Mean	SD	Mean	SD	Mean	SD	
Age (years)[a]	59.2[b,c]	11.7	56.0[b,d]	15.4	64.7[c,d]	13.2	<0.0001
AUDIT-C assessments[e]	9.5[b,c]	4.6	8.3[b,d]	4.3	8.8[c,d]	4.3	<0.0001
	N	%	N	%	N	%	
Alcohol-related characteristics							
Highest AUDIT-C score							<0.0001
No risk (0)	25,733[b]	21.7	7,637[b,d]	16.9	103,114[d]	21.7	
Low risk (1–3)	46,371[b,c]	39.1	19,090[b,d]	42.1	193,946[c,d]	40.9	
Moderate risk (4–7)	28,004[b,c]	23.6	11,531[b,d]	25.4	126,711[c,d]	26.7	
High risk (≥8)	18,492[c]	15.6	7,072[d]	15.6	50,503[c,d]	10.7	
Alcohol use disorder	39,690[b,c]	33.5	11,296[b,d]	24.9	85,981[c,d]	18.1	<0.0001
Alcohol-specific diagnosis							
Cirrhosis	1,825[b,c]	1.5	1,025[b,d]	2.3	6,404[c,d]	1.4	<0.0001
Neuropathy	305[b]	0.3	48[b,d]	0.1	1,188[d]	0.3	<0.0001
Cardiomyopathy	395[b,c]	0.3	54[b]	0.1	726[c]	0.2	<0.0001
Gastritis	457[b,c]	0.4	114[b]	0.3	1,111[c]	0.2	<0.0001
Fatty liver disease	619[b,c]	0.5	310[b,d]	0.7	2,209[c,d]	0.5	<0.0001
Hepatitis	842[c]	0.7	296[d]	0.7	2,530[c,d]	0.5	<0.0001
Liver damage	517[c]	0.4	226[d]	0.5	1,495[c,d]	0.3	<0.0001
Other clinical ICD-9 and ICD-10 diagnoses							
Drug abuse or dependence	34,443[b,c]	29.0	7,347[b,d]	16.2	51,143[c,d]	10.8	<0.0001
Alcohol use disorder and drug abuse or dependence	27,232[b,c]	23.0	5,459[b,d]	12.0	35,477[c,d]	7.5	<0.0001
Mental disorder	68,290[b,c]	57.6	27,455[b,d]	60.6	220,536[c,d]	46.5	<0.0001
Alcohol use disorder and mental disorder	31,181[b,c]	26.3	9,498[b,d]	21.0	65,847[c,d]	13.9	<0.0001
Women							
	N	%	N	%	N	%	
Total sample (N=61,808)	18,460	29.9	5,092	8.2	38,256	61.9	
	Mean	SD	Mean	SD	Mean	SD	
Age (years)[a]	49.2[b,c]	11.3	43.7[b,d]	13.1	52.6[c,d]	13.9	<0.0001
AUDIT-C assessments	9.2[b,c]	4.3	7.8[b,d]	4.1	8.9[c,d]	4.3	<0.0001
	N	%	N	%	N	%	
Alcohol use characteristics							
Highest AUDIT-C score							<0.0001
No risk (0)	3,664[b,c]	19.9	694[b,d]	13.6	6,694[c,d]	17.5	
Low risk (1, 2)	8,639[c]	46.8	2,431[d]	47.7	17,389[c,d]	45.5	
Moderate risk (3–7)	5,080[b,c]	27.5	1,647[b]	32.3	12,172[c]	31.8	
High risk (≥8)	1,077[c]	5.8	320[d]	6.3	2,001[c,d]	5.2	
Alcohol use disorder	2,772[b,c]	15.0	672[b]	13.2	5,052[c]	13.2	<0.0001
Alcohol-specific diagnosis							
Cirrhosis	53[c]	0.3	17	0.3	152[c]	0.4	0.1150
Neuropathy	13	0.1	2	0.0	31	0.1	0.5740
Cardiomyopathy	8	0.0	0	0.0	8	0.0	0.1589
Gastritis	20	0.1	5	0.1	44	0.1	0.9326
Fatty liver disease	24[b]	0.1	14[b]	0.3	74	0.2	0.0651
Hepatitis	33[c]	0.2	12	0.2	103[c]	0.3	0.1182
Liver damage	26	0.1	5	0.1	57	0.2	0.6636

continued

TABLE 1, *continued*

Characteristic	Black		Hispanic		White		p
	N	%	N	%	N	%	
Other clinical ICD-9 and ICD-10 diagnoses							
Drug abuse or dependence	2,436[b,c]	13.2	495[b,d]	9.7	4,276[c,d]	11.2	<0.0001
Alcohol use disorder and drug abuse or dependence	1,578[b,c]	8.6	307[b]	6.0	2,468[c]	6.5	<0.0001
Mental disorder	13,154[b,c]	71.3	3,739[b,d]	73.4	26,773[c,d]	70.0	<0.0001
Alcohol use disorder and mental disorder	2,621[b,c]	14.2	645[b]	12.7	4,786[c]	12.5	<0.0001

[a] Number of observations with missing age: Black men, N=5; Hispanic men, N=8; White men, N=42; Black women, N=1; Hispanic women, N=1; and White women, N=3.
[b] Black versus Hispanic pairwise comparison significant at p<0.05.
[c] Black versus White pairwise comparison significant at p<0.05.
[d] Hispanic versus White pairwise comparison significant at p<0.05.
[e] AUDIT-C=consumption subscale of the Alcohol Use Disorders Identification Test.

indicated by total AUDIT-C score, we examined the association between the maximum score on item 3 and AUD diagnosis as a function of race and ethnicity.

Demographic characteristics and clinical diagnoses. Sex (male or female) and age at enrollment (calculated from month and year of birth and date of MVP enrollment) were extracted from MVP surveys and EHRs; as described above, when sex or age was missing from the MVP survey, data from the EHRs were used (23). We used sex in our study because gender is not well captured in VA EHRs. Clinical diagnoses, including AUD, alcohol-related medical disorders (cirrhosis, neuropathy, cardiomyopathy, gastritis, fatty liver disease, hepatitis, and liver damage), drug use disorders (abuse of or dependence on opioids, cannabis, barbiturates, cocaine, amphetamines and other stimulants, sedatives, and other psychoactive substances), and mental disorders (schizophrenia, schizoaffective disorders, bipolar disorder, posttraumatic stress disorder, and anxiety disorders) required the presence of one relevant inpatient or two relevant outpatient ICD-9 or ICD-10 diagnostic codes in the EHR (see specific ICD codes in Table S2 in the online supplement).

Data Analysis

All statistical tests were two-tailed, with an alpha of 0.05 used to indicate statistical significance, and were performed using SAS, version 9.2. Descriptive statistics by racial and ethnic group include means, standard deviations, and frequencies. We compared characteristics across racial and ethnic groups with analysis of variance and Tukey's post hoc tests, chi-square tests, and Fisher's exact tests. We used Spearman's rho as the unadjusted correlation between maximum AUDIT-C score and AUD diagnosis and a chi-square test to examine the relationship between heavy episodic drinking frequency and AUD diagnosis. We used logistic regression to measure the adjusted association between AUDIT-C score and AUD diagnosis and other factors associated with an AUD diagnosis. We used a composite variable comprising race and ethnicity and maximum AUDIT-C score to assess the interaction effect on the likelihood of an AUD diagnosis. This 39-level nominal variable was created by combining the three-level race and ethnicity variable with the 13-level AUDIT-C variable (e.g., race=Black, AUDIT-C=0, composite=Black_0), representing all possible combinations of the two variables. We probed significant interactions with logistic regression models stratified by AUDIT-C score and applied a Bonferroni correction to adjust for multiple comparisons. To examine sex differences by race and ethnicity, we used logistic regression models stratified by race and ethnicity. To assess the robustness of estimates in the primary analysis, we conducted three sensitivity analyses: we substituted age-adjusted mean AUDIT-C score for maximum AUDIT-C score; we removed individuals with a maximum AUDIT-C score of 0 (i.e., individuals with lifetime abstention and those who quit drinking, often due to alcohol-related problems; this is a heterogeneous group previously described in detail [29, 30]); and we removed individuals with an AUD diagnosis date prior to October 1, 2007 (i.e., the date of the earliest AUDIT-C score in the analysis). For all models, C-statistics served to assess goodness of fit.

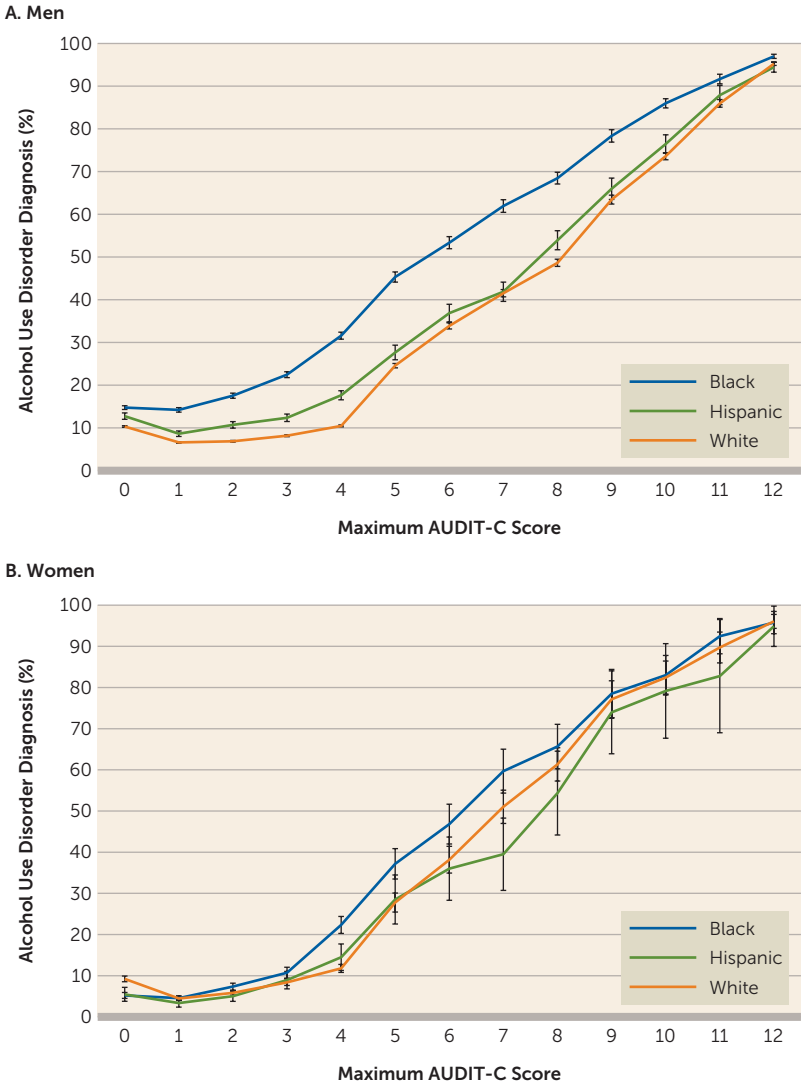
RESULTS

Ninety-one percent of the study sample were men (N=638,204), and 9% were women (N=61,808) (Table 1).

Men

Sample characteristics. The racial and ethnic distribution was 74% White, 19% Black, and 7% Hispanic (Table 1). The modal maximal AUDIT-C score range was 1 to 3 across the three groups, reflecting low risk for harmful drinking. Black male veterans had more AUDIT-C assessments (mean=9.5, SD=4.6) than Hispanic (mean=8.3, SD=4.3) or White (mean=8.8, SD=4.3) male veterans, and Black male veterans had a higher frequency of diagnoses of AUD (34%, 25%, and 18%, respectively) and drug use disorder (29%, 16%, and 11%, respectively) than Hispanic or White male veterans. Although statistically significant, differences in the prevalence of alcohol-related diagnoses across racial and ethnic groups were small. White men had a lower frequency of mental

FIGURE 1. Percentage of veterans participating in the Million Veteran Program and diagnosed with alcohol use disorder as a function of maximum AUDIT-C score, stratified by race and ethnicity[a]



[a] Panel A shows data for men (N=638,204), and panel B shows data for women (N=61,808). The connecting lines are for visualization purposes only and the data should not be interpreted as continuous. AUDIT-C=consumption subscale of the Alcohol Use Disorders Identification Test.

disorder diagnoses (47%) than Black (58%) or Hispanic (61%) men.

Racial and ethnic differences in the association between AUDIT-C score and AUD diagnosis. The correlation between AUDIT-C score and AUD diagnosis was lowest among White men (rho=0.36, p<0.0001), followed by Hispanic (rho=0.42, p<0.0001) and Black (rho=0.47, p<0.0001) men. At every maximum AUDIT-C score, White men were less likely than Black men to receive an AUD diagnosis (all p values <0.0001) (Figure 1A). The greatest difference was at an AUDIT-C score of 4 (i.e., the positive screening cutoff score for men), where White men were approximately one-third as likely to have an AUD diagnosis as Black men. Although Hispanic men had a lower frequency of AUD diagnosis than Black men across all AUDIT-C scores, the frequency was generally higher than that among White men, with the greatest difference also at an AUDIT-C score of 4 (p<0.0001). The greatest difference between Hispanic and Black men was at an AUDIT-C score of 7, where Hispanic men were almost one-third less likely than Black men to have an AUD diagnosis (p<0.0001).

Irrespective of heavy episodic drinking frequency, Black men were significantly more likely than Hispanic or White men to have an AUD diagnosis (all p values <0.0001) (see Figure S3A in the online supplement). Overall, Hispanic men were more likely than White men to have an AUD diagnosis irrespective of heavy episodic drinking frequency.

Multivariable analysis. Multivariable analyses, which adjusted for alcohol consumption and other potential confounders (Table 2), showed that White men were less likely than Black or Hispanic men to receive an AUD diagnosis. Post hoc analysis of the significant interaction between race and ethnicity and AUD diagnosis by alcohol consumption level (Figure 2) revealed that Black men had 23%–109% greater odds of an AUD diagnosis than White men at maximum AUDIT-C scores of 1 to 10 (all p values ≤0.0002). At an AUDIT-C score of 4, the odds of an AUD diagnosis among Black men were more than double the odds among White men (p<0.0001). Hispanic men were significantly more likely than White men to have an AUD diagnosis at maximum AUDIT-C scores of 2 to 4 (all p values ≤0.0002), with the highest odds at an AUDIT-C score of 2 (p<0.0001). Hispanic men were significantly less likely than Black men to have an AUD diagnosis at maximum AUDIT-C scores of 1 to 8 (all p values <0.0001), with the lowest odds at an AUDIT-C score of 4 (p<0.0001).

Among all men, having a diagnosis of a drug use disorder was associated with nearly 13-fold increased odds of an AUD diagnosis (p<0.0001). Greater age, having a mental disorder diagnosis, and having alcohol-related medical disorders were also associated with significantly greater odds of an AUD diagnosis (p<0.0001).

Women

Sample characteristics. The racial and ethnic distribution among women was 62% White, 30% Black, and 8% Hispanic (Table 1). The modal maximal AUDIT-C score range was 1 to 2 for each group, reflecting low risk for harmful drinking. Black female veterans had more AUDIT-C assessments on average (mean=9.2, SD=4.3) than Hispanic (mean=7.8,

TABLE 2. Factors associated with alcohol use disorder diagnosis in the overall sample of veterans participating in the Million Veteran Program and in groups stratified by sex[a]

	Overall (N=699,952)			Men (N=638,149)			Women (N=61,803)		
Variables	Adjusted Odds Ratio	95% CI	p	Adjusted Odds Ratio	95% CI	p	Adjusted Odds Ratio	95% CI	p
Race and ethnicity × highest AUDIT-C score			<0.0001			<0.0001			<0.0001
Black (reference=White)	1.92	1.81, 2.03	<0.0001	2.03	1.91, 2.15	<0.0001	1.21	1.02, 1.44	0.0318
Hispanic (reference=White)	1.25	1.14, 1.38	<0.0001	1.27	1.15, 1.40	<0.0001	1.04	0.77, 1.41	0.8013
Women (reference=men)	0.67	0.65, 0.69	<0.0001	-	-	-	-	-	-
Age (10-year increments)	1.05	1.04, 1.05	<0.0001	1.05	1.04, 1.05	<0.0001	1.08	1.06, 1.11	<0.0001
Alcohol-related diagnosis									
Cirrhosis	15.94	14.80, 17.18	<0.0001	15.76	14.61, 16.99	<0.0001	20.40	12.24, 34.02	<0.0001
Neuropathy	14.34	11.52, 17.85	<0.0001	13.79	11.06, 17.19	<0.0001	174.67	17.41, >999.99	<0.0001
Cardiomyopathy	16.48	13.27, 20.46	<0.0001	16.28	13.10, 20.24	<0.0001	32.17	4.83, 214.21	0.0003
Gastritis	30.24	19.62, 46.60	<0.0001	30.65	19.60, 47.94	<0.0001	21.23	3.99, 113.02	0.0003
Fatty liver disease	4.67	4.15, 5.25	<0.0001	4.68	4.15, 5.28	<0.0001	4.70	2.52, 8.77	<0.0001
Hepatitis	14.74	11.70, 18.56	<0.0001	15.50	12.22, 19.66	<0.0001	4.77	1.89, 12.05	0.0009
Liver damage	8.36	6.80, 10.28	<0.0001	8.03	6.50, 9.90	<0.0001	21.62	7.09, 65.96	<0.0001
Other clinical ICD-9 and ICD-10 diagnoses									
Drug use disorder	12.79	12.53, 13.05	<0.0001	12.66	12.40, 12.93	<0.0001	13.16	12.27, 14.12	<0.0001
Mental disorder	3.21	3.16, 3.27	<0.0001	3.16	3.10, 3.22	<0.0001	5.08	4.53, 5.69	<0.0001
C-statistic	0.91			0.90			0.91		

[a] The odds ratios are those at the mean highest AUDIT-C score (mean scores of 3, 3, and 2 for overall, men, and women, respectively). Number of observations with missing age: Black men, N=5; Hispanic men, N=8; White men, N=42; Black women, N=1; Hispanic women, N=1; and White women, N=3. AUDIT-C=consumption subscale of the Alcohol Use Disorders Identification Test.

SD=4.1) and White (mean=8.9, SD=4.3) female veterans. The frequency of AUD diagnosis among Black women (15%) was significantly higher than among White or Hispanic women (both 13%; $p<0.0001$ and $p=0.001$, respectively). The frequency of a drug use disorder was highest among Black women (13%) and lowest among Hispanic women (10%). The frequency of a mental disorder diagnosis was higher among Hispanic women (73%) than among Black (71%) or White (70%) women. Significant racial and ethnic group differences in the prevalence of other alcohol-related diagnoses were small.

Racial and ethnic differences in the association between AUDIT-C score and AUD diagnosis. The correlation between AUDIT-C score and AUD diagnosis was lower among White women (rho=0.30, $p<0.0001$) than Hispanic (rho=0.37, $p<0.0001$) or Black (rho=0.40, $p<0.0001$) women. Black women had a higher likelihood of an AUD diagnosis than White or Hispanic women at nearly every level of alcohol consumption (Figure 1B), which was significant at AUDIT-C scores of 2 and 4 to 7 (all p values <0.05). At AUDIT-C scores of 0 and 7, White women were more likely than Hispanic women to have an AUD diagnosis. The maximal difference in the proportion of individuals with an AUD diagnosis between Black and White women was at an AUDIT-C score of 4 (22% vs. 12%, respectively; $p<0.0001$).

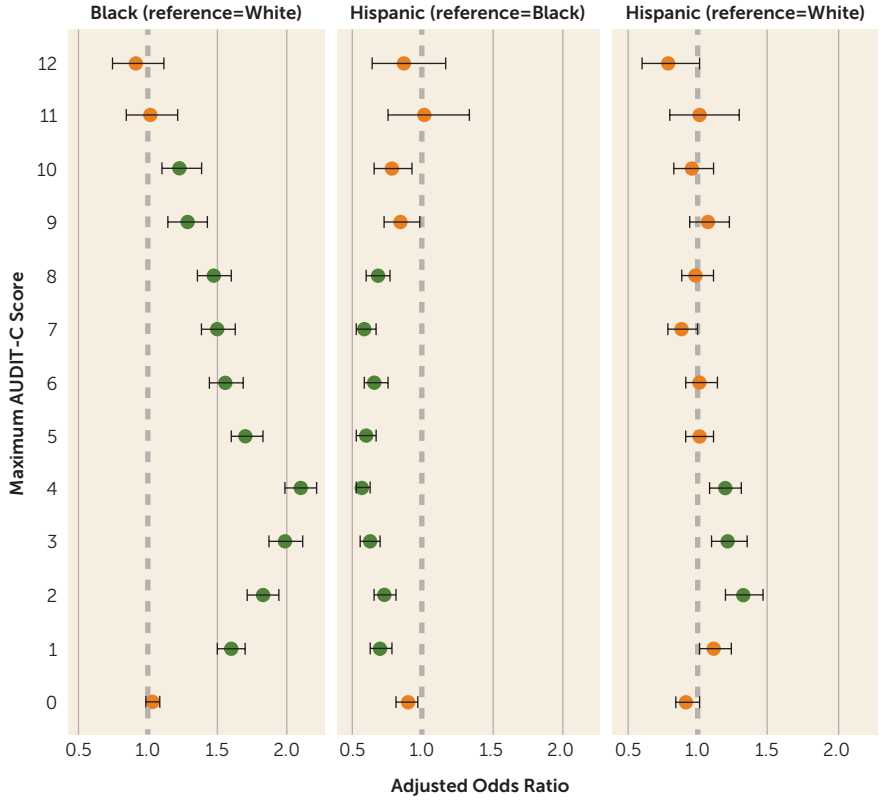
Racial and ethnic differences in the association between AUD frequency and heavy episodic drinking were also observed among women. Black women were more likely than Hispanic women to receive an AUD diagnosis when reporting heavy episodic drinking weekly or less often (AUDIT-C item 3 scores of 0 to 3; all p values ≤0.01) (see Figure S3B in the online supplement).

Multivariable analysis. The overall interaction between race and ethnicity and maximum AUDIT-C score on AUD diagnosis was significant ($p<0.0001$) (Table 2). Specifically, Black women had a higher probability of an AUD diagnosis than Hispanic or White women at moderate AUDIT-C scores, and Hispanic women had a lower probability than Black or White women of an AUD diagnosis at higher AUDIT-C scores (see Figure S4 in the online supplement). A diagnosis of a drug use disorder was associated with a >13-fold increased odds of an AUD diagnosis ($p<0.0001$) (Table 2). Older women and those with a mental disorder diagnosis or alcohol-related health conditions had significantly greater odds of an AUD diagnosis (all p values <0.001) (Table 2).

Sex Differences in AUD Diagnosis

After adjusting for alcohol consumption and other potential confounders, women had significantly lower odds of an AUD diagnosis than men overall and when stratified by race and ethnicity (Table 2). Compared to their male counterparts, Black women had the lowest odds of an AUD diagnosis (adjusted odds ratio=0.57, $p<0.001$), followed by White women (adjusted odds ratio=0.68, $p<0.001$) and Hispanic women (adjusted odds ratio=0.70, $p<0.001$) (see Table S3 in the online supplement).

FIGURE 2. Forest plots of adjusted odds ratios for the association between race and ethnicity and diagnosis of alcohol use disorder among men, stratified by maximum AUDIT-C score (N=638,149)[a]



[a] Models were adjusted for age at enrollment, drug abuse or dependence, mental disorders, and alcohol-specific diagnoses, including cirrhosis, neuropathy, cardiomyopathy, gastritis, fatty liver disease, hepatitis, and liver damage. Green symbols represent a significant difference between the comparison and reference groups; orange symbols represent a nonsignificant difference between groups. A Bonferroni-corrected alpha of 0.001 was used to determine statistical significance. Error bars indicate 95% confidence intervals. AUDIT-C=consumption subscale of the Alcohol Use Disorders Identification Test.

Sensitivity Analyses

Sensitivity analysis using age-adjusted mean AUDIT-C score. An analysis using age-adjusted mean rather than maximum AUDIT-C score did not substantially affect the overall findings or the differences within sexes (see Table S4 in the online supplement).

Sensitivity analysis excluding individuals with maximum AUDIT-C score of 0. When the analytic sample was restricted to individuals with a maximum AUDIT-C score >0 (N= 552,437), there were no meaningful changes in the overall findings or in the findings among men (see Table S5 in the online supplement). Among women, although the overall interaction between race and ethnicity and maximum AUDIT-C score remained significant, the comparison of Black and White women at a maximum AUDIT-C score of 3 (i.e., the mean AUDIT-C score among women with maximum AUDIT-C >0) was not significant (see Table S5 in the online supplement).

Sensitivity analysis restricting AUD diagnosis date. The removal of individuals with an AUD diagnosis prior to October 7, 2010, reversed the direction of the overall age effect and the effect within sexes: older age became associated with reduced odds of an AUD diagnosis (see Table S6 in the online supplement). This finding is likely because the average age of individuals with an AUD diagnosis in the primary analysis was 57.9 years (SD=12.3) and the average age of those with an AUD diagnosis in the sample for this sensitivity analysis was 55.5 years (SD=13.6). Among women, the overall interaction between race and ethnicity and maximum AUDIT-C score remained significant, although the comparison of Black and White women at a maximum AUDIT-C score of 2 (i.e., the mean AUDIT-C score among women in the date-restricted sample) was not significant (see Table S6 in the online supplement). No other findings changed significantly.

DISCUSSION

In this sample of more than 700,000 veterans, we identified a differential frequency of AUD diagnosis by race and ethnicity. The greatest discrepancy was among Black men, who, at all but the lowest and highest levels of alcohol consumption, had 23%–109% greater odds of an AUD diagnosis than White men. Hispanic men had 20%–32% greater odds of an AUD diagnosis than White men. The prevalence of disorders associated with persistent heavy drinking (e.g., alcoholic cirrhosis and hepatitis), whose diagnoses generally rely on objective measures (e.g., laboratory values and ultrasound findings), was similar across the three groups, which suggests that the greater likelihood of an AUD diagnosis among Black and Hispanic veterans was likely not due to different levels of alcohol consumption. The association between race and ethnicity and AUD diagnosis remained after adjustment for alcohol consumption level, alcohol-related disorders, drug use disorders, and other potential confounders.

The sample for which we had EHR data on self-reported alcohol consumption and AUD diagnosis was large enough to account for multiple potential contributing factors. The frequency of AUD here (21% overall) was lower than that in the general population estimate (29%) from the National Epidemiologic Survey on Alcohol and Related Conditions–III (NESARC-III) (31), and the frequency was lower among

both men (22% here vs. 36% in NESARC-III) and women (14% here vs. 23% in NESARC-III). Notably, the VA EHR data are cumulative over approximately 20 years of available data, compared with lifetime estimates in NESARC-III. In a previous VA study (10), the frequency of AUD was 10% among Black veterans, 7% among Hispanic veterans, and 6% among White veterans, compared with 31%, 24%, and 18%, respectively, in the present study. Despite the use of diagnostic data from a single year in that study, rather than the cumulative estimate from the VA EHR obtained in the present study, both studies found the same order of AUD frequencies by race and ethnicity, which was opposite that found in NESARC-III, where Black individuals had the lowest lifetime AUD prevalence (22%), followed by Hispanic (23%) and White (33%) individuals.

Notably, NESARC-III used a structured diagnostic interview, which is likely to be more accurate (i.e., less biased) than a clinical interview, as is used in the VA, which could also contribute to the higher prevalence of AUD in the general population than in the VA population. Our findings in the VA population highlight differential clinical assessment of AUD by race and ethnicity, and this difference could be due to overdiagnosis of Black veterans, underdiagnosis of White veterans, or, more likely, a combination of the two. Both kinds of misdiagnosis can have harmful effects, because overdiagnosis can be stigmatizing and underdiagnosis can delay treatment. Consistent with the observation that there are disparities in the diagnosis of AUD associated with race and ethnicity, the strength of correlations between AUDIT-C score and AUD diagnosis increased monotonically in both sexes. Specifically, White veterans showed the lowest correlation between AUDIT-C score and AUD diagnosis, Hispanic veterans showed an intermediate correlation, and Black veterans showed the highest correlation. The findings suggest that White veterans are underdiagnosed with AUD. Despite a higher rate of referral and treatment for AUD among Black veterans than among White or Hispanic veterans (11), the available data do not allow us to determine the net impact of the diagnostic differences on patient outcomes. Any potential benefit of greater treatment rates should not overshadow the central issue that racialized inequity in assessment, particularly of Black patients, appears to exist. Studies are needed to examine the mechanism by which veterans receive an AUD diagnosis and multilevel factors such as bias and systemic racism that likely affect the observed inequity.

The greatest disparity in AUD diagnosis after adjustment for potential confounders occurred at maximum AUDIT-C scores of 3 and 4, near the cutoff for a positive AUDIT-C screen (≥3 for women; ≥4 for men). These findings suggest that, at scores near the threshold, providers are more likely to assign a diagnosis of AUD to Black or Hispanic than White veterans (6, 32, 33). In a series of experiments that evaluated implicit stereotyping, physicians were more likely to associate stigmatizing medical conditions (e.g., drug use and HIV) with Black than White patients (6, 32), suggesting that diagnostic disparities may reflect implicit bias. Studies of diagnostic disparities suggest that they could result from the differential presentation of psychiatric symptoms across racial and ethnic groups (10, 21). Although this perspective could reflect the impact of culture on psychiatric symptom presentation (34), it also indirectly acknowledges that diagnostic science and practice reference the White experience.

Research has also shown that psychological distress and social disadvantage (including factors such as poverty, racial and ethnic stigma, unfair treatment, and cumulative disadvantage) can contribute to persistent racial and ethnic disparities among individuals with alcohol dependence despite lower levels of heavy alcohol consumption (21, 35, 36). Although social disadvantage likely mediates or moderates the associations identified in the present study, as observed in other studies using national samples (21, 35, 36), we did not have access to such measures. The interrelationships of race and ethnicity and social disadvantage and their effects on alcohol-related problems are complex and merit in-depth exploration in the veteran population.

We found that the presence of a diagnosis of a drug use disorder and an AUD diagnosis were highly correlated. These disorders commonly co-occur, both in the VA population (37) and the general population (31, 38). In NESARC-III, the prevalence of a concurrent AUD and drug use disorder (which may include cannabis and tobacco use disorders) did not differ substantially by race and ethnicity (Black, 9%; Hispanic, 7%; White, 8%) (34). However, in the present study sample, Black men were over three times (23%) and Hispanic men were 1.5 times as likely (12%) as White men to have at least one comorbid drug use disorder (8%). This may be because once a patient receives an AUD diagnosis, providers are more likely to query the patient about use of other substances or vice versa. The findings may also reflect implicit bias toward Black and Hispanic veterans, which prompts additional screening for use of other substances in these populations (6, 39, 40).

More research is needed to understand the source of these differences. To aid in the valid diagnosis and treatment of the use of multiple substances, standardized screening and assessment methods are recommended. This, by itself, however, may not be adequate, as there are multiple examples of racial bias in medicine that occur even when objective tests are used. A commonly cited example is the estimated glomerular filtration rate, where different formulas have been used for Black and White patients. This has led to less access to kidney transplant for Black than White individuals, despite comparable levels of severity of renal disease. Other examples of biased algorithms include those used to predict the risk posed by a trial of labor in women who have previously delivered a baby via cesarean section, the risk of developing breast cancer, the risk of developing a kidney stone, and the use of spirometry to measure lung function, among others (41).

In our study, women were less likely than men to receive an AUD diagnosis, consistent with population estimates (42) and findings among veterans (43). Although women consume less alcohol than men, this difference has been decreasing in recent years (44). In studies of unhealthy alcohol use, women experience greater alcohol use–related stigma than men (45), which could impact how providers respond to (46) and document (20) alcohol use among women. More research is needed to understand sex and gender differences, and their intersection with race and ethnicity, in substance use reporting and documentation in the medical record.

Similar to the findings among men, at nearly every level of alcohol consumption, Black women were more likely than Hispanic and White women to receive an AUD diagnosis, despite having a similar distribution of alcohol consumption and prevalence of alcohol-related disorders among the groups. There were few differences in the relationship between AUD frequency and alcohol consumption between Hispanic and White women. Where such differences were present, White women had a greater frequency of AUD diagnosis than Hispanic women, consistent with estimates from the 2019 National Survey on Drug Use and Health, where alcohol use prevalence was higher among non-Hispanic White women than Hispanic women (42).

Our study has several limitations. Despite obvious differences in the frequency of AUD diagnosis by racial and ethnic group, the basis for the discrepancies cannot be ascertained using EHR data, and we did not have information on how diagnoses were made. Second, self-reported measures of alcohol consumption may be subject to recall bias. In two U.S. national surveys (total N >494,000) that used AUDIT-C data from participants who reported past-year drinking (47) approximately 20% of male and female veterans reported drinking levels that were inconsistent with screening results based on standard cutoff scores. Because the available data did not permit a conclusion to be drawn as to the source of the discrepancies, objective measures of alcohol use (e.g., biomarkers) are needed to validate self-reports. Third, we did not have data on socioeconomic or social disadvantage factors, which may have mediated or moderated the associations identified in this study. Fourth, findings from a sample of U.S. veterans enrolled in a genetic cohort study may not generalize to other populations, including the general veteran population. Lastly, the substantially smaller number of female relative to male veterans provided less statistical power to detect differences among women.

Our study also has notable strengths. The availability of annual assessments of alcohol consumption and informative EHRs enabled us to analyze relationships between measures of alcohol consumption and AUD diagnosis, with analyses that included multiple clinical factors that could influence these associations. Whereas previous studies could analyze data spanning only several years (10–13, 20), we analyzed data from individuals' entire VA EHRs. Second, the large and diverse sample, particularly of men, provided enough statistical power to examine factors that affect the likelihood of an AUD diagnosis.

CONCLUSIONS

We identified a large, racialized difference in AUD diagnosis, with Black and Hispanic veterans more likely than White veterans to receive the diagnosis at the same level of alcohol consumption. The absence of other factors to explain this discrepancy strongly suggests the presence of racial and ethnic biases in the diagnosis of AUD by VA practitioners. These findings should encourage the VA to examine the causes of observed differences by conducting prospective studies, which could include simulated patients and a diverse group of practitioners whose interactions are recorded and analyzed. These evaluations, together with post hoc interviews with practitioners, could provide insights into the diagnostic thought process and how it is affected by race and ethnicity. Insights resulting from such efforts could guide changes in screening and diagnostic methods. Other options for reducing these disparities include greater use of structured diagnostic interviews, enhanced education in diagnosing AUD, and the identification and remediation of multilevel bias and racism-related contributors to racialized differences in diagnosis.

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Examination Questions for Racial and Ethnic Bias in the Diagnosis of Alcohol Use Disorder in Veterans

1. **At the cutoff for a positive AUDIT-C screen for men (i.e., a score that reflects unhealthy alcohol use), Black men had ___ the odds of an AUD diagnosis of White men.**
   A. more than twice
   B. less than half
   C. equal
   D. 23% times
2. **At most maximum AUDIT-C scores, Hispanic men were ___ likely than Black men to have an AUD diagnosis.**
   A. equally
   B. less
   C. more than three times as
   D. more than twice as
3. **Identify the correct order of correlation between AUDIT-C score and AUD diagnosis by racial and ethnic group, from highest correlation to lowest:**
   A. Black men, White men, Hispanic men
   B. White men, Hispanic men, Black men
   C. Hispanic men, White men, Black men
   D. Black men, Hispanic men, White men