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# Racial Disparities in the Association between Alcohol Use Disorders and Health in Black and White Women

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**ABSTRACT**

Adverse health attributed to alcohol use disorders (AUD) is more pronounced among black than white women. We investigated whether socioeconomic status (education and income), health care factors (insurance, alcoholism treatment), or psychosocial stressors (stressful life events, racial discrimination, alcoholism stigma) could account for black-white differences in the association between AUD and physical and functional health among current women drinkers 25 years and older ($N$ = 8,877) in the National Epidemiological Survey on Alcohol and Related Conditions. Generalized linear regression tested how race interacted with the association between 12-month *DSM-IV* AUD in Wave 1 (2001–2002) and health in Wave 2 (2004–2005), adjusted for covariates (age group, alcohol consumption, smoking, body mass index, physical activity, diabetes, cardiovascular disease, and arthritis). Black women with AUD had poorer health than white women with AUD ($\beta = -3.18$, $SE = 1.28$, $p < .05$). This association was partially attenuated after adjusting for socioeconomic status, health care, and psychosocial factors ($\beta = -2.64$, $SE = 1.27$, $p < .05$). In race-specific analyses, AUD was associated with poorer health for black but not white women. Accounting for black-white differences in AUD and physical and functional health among women requires investigation beyond traditional explanatory mechanisms.

## Background

Alcohol use disorders (AUD) are psychiatric conditions diagnosed in the context of compulsive and excessive drinking that cause harm to oneself or another (Dawson 2011; Peterson, Nisenholz, and Robinson 2003). AUD is a major international public health problem. Four and one-half percent of the global burden of disease and injury has been attributed to AUD (World Health Organization 2011). In the United States (US), at least 30 percent of individuals meet an AUD diagnosis in their lifetime (Hasin et al. 2007). Furthermore, AUD is the third leading lifestyle-related cause of preventable death in the US, corresponding to an estimated 88,000 deaths annually (National Institute on Alcohol Abuse and Alcoholism 2016). US health care expenditures for AUD are high, estimated at $223.5 billion in a given year (Bouchery et al. 2011).

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Excessive alcohol use, an implicit criterion of an AUD diagnosis (Dawson 2000), damages the central nervous and digestive systems and aggravates inflammatory markers (Agarwal and Seitz 2001) that are causally associated with poorer physical and functional health (Friedman, Christ, and Mroczek 2015). Physical/functional health, an important metric of population health (Burdine et al. 2000), is characterized by indicators including physical functioning, role limitations resulting from physical health problems, self-rated general health, and bodily pain (Ware, Kosinski, and Keller 1996). These physical and functional limitations are costly to society. For example, one study estimated US health care expenditures for people with physical and functional limitations and disabilities at $220 billion, or approximately 9.3 percent of total health care expenditures, in 2012 (O'Shaughnessy 2014).

Compared to men, women suffer a greater number and severity of health consequences attributed to AUD (Hommer et al. 2001; Streissguth 2012; United States Department of Health and Human Services 2008; Wilsnack et al. 2000), despite women's lower alcohol consumption and both 12-month and lifetime AUD risk (Grant et al. 2011). Biological differences in the body's ability to process alcohol partly explain women's worse alcohol-attributed health sequelae than men's (Baraona et al. 2001; Holmila and Raitasalo 2005). The association between AUD and poorer health among women has also been attributed to women being less likely to self-identify as having a drinking problem before the evidence is clinically obvious (Jarque-López et al. 2001).

There is strong evidence that race plays a modifying role in the association between AUD and health, particularly among black and white women (Chartier, Hesselbrock, and Hesselbrock 2013; Griffin et al. 2000; National Center on Addiction and Substance Abuse at Columbia University 2006). Nationally representative data indicate that black women have a lower lifetime risk of alcohol abuse than white women (9.1 percent vs. 13.3 percent) and a lower lifetime risk of alcohol dependence than white women (4.8 percent vs. 7.9 percent) (Zemore et al. 2014). Despite their lower AUD risk than white women, black women suffer a greater health burden attributed to AUD (Chartier, Hesselbrock, and Hesselbrock 2013, Centers for Disease Control and Prevention 2011; Jackson et al. 2015). For example, Fuchs et al. (2004, 471) showed that the hazard ratio for incident coronary heart disease was 1.33 among former drinking black women but 0.91 among white women. More recently, C. L. Jackson et al. (2015, e7) found that among current drinkers who consumed two or greater number of drinks three to seven days per week, black women had a mortality rate of 141.2 per 100,000 person years compared to 79.7 among white women. Although several studies demonstrate a pattern of more adverse health for black than white persons at similar levels of alcohol misuse (Chartier, Hesselbrock, and Hesselbrock 2013; Jones-Webb et al. 1997; Mulia et al. 2008; Pacek, Malcolm, and Martins 2012; Zemore et al. 2014), explanations for this paradoxical association among black and white women remain unclear given the limited evidence on this topic (Zapolski et al. 2014).

In this study, we aim to add new evidence about black-white differences in the AUD-health association among women. We also endeavor to foster an understanding of these differences by investigating a range of factors that have been put forth to explain racial and ethnic disparities generally, and particularly among women (Dressler, Oths, and Gravlee 2005; Godette, Headen, and Ford 2006; Nolen-Hoeksema 2004; Williams and Jackson

2005). Specifically, we examine the factors of socioeconomic status, health care access and utilization, and psychosocial stressors.

## Methods

### Data and sample

We drew a nationally representative sample of women who were current drinkers (defined as self-reported alcohol use in the past 12 months) from the National Epidemiologic Survey on Alcohol Related Conditions (NESARC), Wave 1 (2001–2002) and Wave 2 (2004–2005). NESARC is a multistate stratified population-based survey that utilized computer-assisted personal interviews to capture health outcomes, behavioral factors, and psychiatric disorders among civilian noninstitutionalized adults in the US (National Institutes of Health and National Institute on Alcohol Abuse and Alcoholism 2010). NESARC oversampled non-Hispanic blacks, Hispanics, and persons aged 18–24. The data were weighted to adjust for the probabilities of selecting households, selecting one person per household, oversampling, and nonresponse. Further details of NESARC sampling methodology have been published (Grant and Dawson 2006; Ruan et al. 2008). Wave 1 consisted of 43,093 respondents with an overall response rate of 81 percent. From Wave 1, 39,959 individuals remained eligible at Wave 2, and 34,653 total respondent interviews were completed at Wave 2 for an overall response rate of 86.7 percent (National Institutes of Health and National Institute on Alcohol Abuse and Alcoholism 2010). NESARC contained a sample of 8,877 current drinkers among non-Hispanic black and white women aged 25 years and older.

### Measures

#### Alcohol use disorders

AUD is the main exposure variable, defined as meeting diagnostic criteria for alcohol abuse and/or alcohol dependence (Grant et al. 2004) as outlined in the *Diagnostic and Statistical Manual of Mental Disorders*, fourth edition (*DSM-IV*) (American Psychiatric Association 2000). AUD was assessed with questions from the Alcohol Use Disorder and Associated Disabilities Interview Schedule (AUDADIS-IV). We used 12-month AUD from Wave 1 (year 2001–2002) as a baseline. Test-retest reliabilities for AUD using AUDADIS-IV were robust for both the general population ($k$ = .76, $SE$ = 0.05) and clinical samples ($k$ = .74, $SE$ = 0.04) (Grant et al. 1995; Hasin et al. 1997). The reliability, validity, and efficacy of identifying AUD among blacks based on the AUDADIS instrument is good (Volk et al. 1997).

#### Race

Self-reported race is the second exposure variable, coded as non-Hispanic black and non-Hispanic white (hereafter, black and white).

#### Physical and functional health

The study outcome is physical and functional health in Wave 2, which is captured by the Short Form 12 Health Survey (SF-12). The measure assesses self-reported limitations in

physical and occupational role functioning such as climbing stairs. The measure also captures bodily pain and general health (Ware, Kosinski, and Keller 1996; Ware, Kosinski, Turner-Bowker, and Gandek 2002). This measure has exhibited strong reliability and validity in household surveys (Ware, Kosinski, and Keller 1996), and it has been validated in the African American population (Larson et al. 2008). The measure is a norm-based summary score, standardized with a range of 0 to 100 and a mean of 50; higher scores indicate better physical and functional health (Ware et al. 2002).

### Mechanisms

We examined the following proposed explanatory factors: socioeconomic status, health care access, stressful life events, racial discrimination, and alcoholism stigma at Wave 2. We operationalized socioeconomic status as highest education completed (less than high school, high school, some college or higher) and personal income ($0–$19,999, $20,000–$34,999, $35,000 and greater), however, these were analyzed continuously to examine linear effects on health. We operationalized health care access as insurance status (private, public, or no insurance) and alcohol treatment utilization, which corresponded to whether a respondent utilized any form of treatment targeted to alcohol use (e.g., Alcoholics Anonymous, detoxification treatment, psychological counseling) within the past 12 months (Keyes et al. 2008).

Additionally, we operationalized psychosocial stressors at Wave 2 with three indicators. Stressful life events are the number of reported stressful life events from a selected list of 11 that respondents could have experienced in the prior 12 months (e.g., death of someone close, major financial crisis, self or family member's trouble with the police) (Dawson, Grant, and Ruan 2005). The second stressor is experiences of racial discrimination (Krieger et al. 2005) categorized by frequency using a five-item Likert-type scale (0 = never to 4 = very often) (Ruan et al. 2008). The third is alcoholism stigma, which measured perceived discrimination and devaluation, where higher summed scores represented higher alcohol-related stigma (Glass, Kristjansson, and Bucholz 2013).

### Other covariates

Sociodemographic covariates included categorical age (25 to 29, 30 to 64, and 65 and older). Health status and lifestyle covariates included current alcohol consumption corresponding to exceeding National Institute on Alcohol Abuse and Alcoholism (NIAAA)-recommended daily drinking limits (light is < 0.257 ounces, moderate is > 0.257–1.2 ounces, and heavy is > 1.2 ounces; National Institutes of Health and National Institute on Alcohol Abuse and Alcoholism 2010), current smoking (yes/no), current self-reported height and weight (used to derive body mass index [BMI], which was log-transformed to normalize a skewed distribution), and physical inactivity (no, moderate, and vigorous physical activity) in Wave 2. Covariates related to physical and functional health included diabetes, cardiovascular diseases (indicated by a doctor-confirmed diagnosis of chest pain or angina, rapid heartbeat, heart attack, or any other form of heart disease), and arthritis (Fleishman and Lawrence 2003).

## Analyses

We restricted the analyses to current drinkers, which is consistent with previous research that examined the association between AUD and health and social outcomes (Mulia, Ye,

Greenfield, and Zemore 2009). We further restricted the sample to age 25 years and older because the majority of physical health consequences related to alcoholism begin to manifest at that age, and racial differences in the onset of alcohol dependence also emerge (Alvanzo et al. 2011; Godette, Headen, and Ford 2006).

We first examined bivariate associations of race on AUD, physical and functional health, and each proposed explanatory factor hypothesized to account for racial differences in health. For categorical variables, we reported unweighted sample sizes with weighted column percentages and used the Rao-Scott chi-square test to assess statistical differences between black and white women. For continuous variables, we reported weighted survey means and linearized standard errors and used the Wald test to assess the significance of race differences in means.

The multivariable sample included individuals with no missing values for AUD, physical and functional health, or the covariates, which yielded an analytic sample of $N$ = 8,603 current drinking non-Hispanic black and white women (97 percent of the original sample of 8,877). We used multivariable generalized linear regression models to compute separately the main effects of race, then AUD, in association with physical and functional health, adjusting for the covariates age group, current smoking, alcohol consumption, BMI, physical activity, diabetes, cardiovascular disease, and arthritis (Model 1). These covariates were included in all subsequent models.

We then computed and tested the interaction for race and AUD in association with physical and functional health in a separate step (Model 2). The interaction variable had two levels (white with AUD and black with AUD), which was estimated in the same equation with the main effects of AUD and race. The reference group is white with AUD, but the interaction coefficient from factorial interactions represents the differences in effects (slopes) of AUD on health between white and black persons. We used the Wald test of contrast to examine the statistical significance of the interaction term. We sequentially added socioeconomic status (Model 3), health care access factors (Model 4), and psychosocial stressors (Model 5) to see whether any of these proposed explanatory factors accounted for the interaction between race and AUD associated with physical and functional health. The order of entering these factors was informed by a framework for studying the role of race in health (Williams 1997). We also calculated the percent reduction in the race × AUD interaction coefficient from Model 2 to Model 5, which included all the mechanisms, with the formula ([Model 2 – Model 5/Model 2] × 100) used in prior research (Stringhini et al. 2010).

We conducted all analyses in Stata 13.0 using the "svy" and "subpop" commands (StataCorp 2014) to restrict the analyses to women and current drinkers. These commands also account for the complex survey design of NESARC, which includes obtaining correct standard errors (Heeringa, West, and Berglund 2010).

## Results

The analytic sample used for the multivariable analysis (i.e., without missing study variables) differed significantly from the missing variables sample for age group (older), race (higher proportion of white women), percentage of those with diabetes, stressful life events (higher mean), and racial discrimination (lower mean frequency). The samples did not differ on AUD prevalence or physical and functional health (Supplement Table 1).

**Table 1.** Sample characteristics of black and white current drinker women age 25 years and older in Wave 2 of the National Epidemiologic Survey of Alcohol and Related Conditions, USA ($N$ = 8,877).

| | Non-Hispanic white ($N$ = 7,034) | Non-Hispanic black ($N$ = 1,843) | $p$ value |
|---|---|---|---|
| **Age** | | | |
| Age group (in years), *n* (%) | | | .000 |
| 25 to 29 | 663 (9.99) | 217 (15.34) | |
| 30 to 64 (reference) | 5,081 (72.54) | 1,485 (78.40) | |
| 65 and older | 1,290 (17.47) | 141 (6.26) | |
| **Health Status and Lifestyle** | | | |
| Alcohol consumption, *n* (%) | | | .005 |
| Light (< 0.257 ounces of alcohol) (reference) | 5,087 (72.65) | 1,379 (74.55) | |
| Moderate (> 0.257 to 1.2 ounces of alcohol) | 1,567 (22.31) | 328 (18.46) | |
| Heavy (> 1.2 ounces of alcohol) | 365 (5.04) | 132 (6.99) | |
| Current smoker, yes, *n* (%) | 1,696 (23.69) | 505 (27.13) | .021 |
| Body mass index, range (23.6–30.9), mean, (*SE*) | 28.35 (0.25) | 30.66 (0.34) | .000 |
| Physical activity, *n* (%) | | | .841 |
| No physical activity (reference) | 6,265 (89.04) | 1,626 (88.61) | |
| Moderate physical activity | 104 (1.60) | 34 (1.55) | |
| Vigorous physical activity | 665 (9.36) | 183 (9.84) | |
| Diabetes, *n* (%) | 335 (4.87) | 156 (8.11) | .000 |
| Cardiovascular disease, *n* (%) | 619 (8.65) | 148 (7.04) | .033 |
| Arthritis, *n* (%) | 1,357 (18.99) | 293 (15.25) | .003 |
| **Socioeconomic Status** | | | |
| Education, *n* (%) | | | .000 |
| Less than high school | 408 (5.83) | 234 (12.49) | |
| Completed high school | 4,192 (60.24) | 1,199 (65.81) | |
| Some college or higher | 2,434 (33.94) | 410 (21.70) | |
| Personal Income, *n* (%) | | | .001 |
| $0–$19,999 | 2,960 (44.42) | 800 (43.39) | |
| $20,000–$34,999 | 1,695 (23.37) | 512 (28.70) | |
| $35,000 and greater | 2,379 (32.22) | 531 (27.91) | |
| **Health Care Access and Utilization** | | | |
| Insurance status, *n* (%) | | | .000 |
| No insurance | 470 (6.60) | 244 (15.23) | |
| Public | 4,679 (66.83) | 962 (52.32) | |
| Private | 1,885 (26.57) | 637 (32.44) | |
| Alcohol treatment utilized, yes, *n* (%) | 65 (0.94) | 29 (1.66) | .047 |
| **Psychosocial Stressors** | | | |
| Stressful life events, range (0–14), mean (*SE*) | 1.41 (0.03) | 2.30 (0.07) | .000 |
| Alcoholism stigma, range (31–43), mean (*SE*) | 35.55 (0.14) | 37.85 (0.33) | .000 |
| Racial/ethnic discrimination, range (1–5), mean (*SE*) | 1.03 (0.00) | 1.23 (0.01) | .000 |
| **12-month Alcohol Use Disorders**[a], *n* (%) | 512 (6.67) | 119 (6.87) | .812 |
| **Physical and Functional Health**, mean (*SE*) | 52.29 (0.15) | 51.20 (0.29) | .001 |

*Note*. Column percentages are weighted, *n*s are unweighted. *SE*: standard linear error.
[a]Alcohol Use Disorders was measured in Wave 1 (2001–2002).

We report sample characteristics in Table 1. The 12-month prevalence of AUD in Wave 1 among current drinking women age 25 years and older was 6.9 percent among black women and 6.7 percent among white women, but the black-white difference was not statistically significant. A lower proportion of black women consumed alcohol moderately (18.5 percent) compared to white women (22.3 percent). Black women were significantly less likely to have a college degree and more likely to be uninsured than white women. Black women also had a higher mean number of stressful life events, experiences of racial discrimination, and alcoholism stigma. The mean physical

and functional health score was 52.3 for black women and 51.2 for white women, and the black-white difference was statistically significant.

In Table 2, we report the main effects of race and AUD as well as the interaction between race and AUD associated with physical and functional health among current

**Table 2.** Multivariable results of race and 12-month *DSM-IV* AUD in Wave 1 associated with current physical and functional health status among current drinker women age 25 years and older in Wave 2 of the National Epidemiologic Survey of Alcohol and Related Conditions, USA ($N$ = 8,603)

| | Model 1 | | Model 2 | | Model 3 | | Model 4 | | Model 5 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | *b* | *SE* | *b* | *SE* | *b* | *SE* | *b* | *SE* | *b* | *SE* |
| Non-Hispanic black | −2.02*** | 0.31 | −1.81*** | 0.31 | −1.51*** | 0.30 | −1.52*** | 0.30 | −1.10** | 0.33 |
| *DSM-IV* Alcohol use disorder (AUD) | −0.18 | 0.44 | 0.14 | 0.48 | 0.06 | 0.47 | 0.03 | 0.47 | 0.16 | 0.48 |
| Black × AUD | | | −3.18* | 1.28 | −2.71* | 1.27 | −2.77* | 1.28 | −2.64* | 1.27 |
| Age group | | | | | | | | | | |
| 25–29 | 1.82*** | 0.28 | 1.82*** | 0.28 | 2.11*** | 0.28 | 2.11*** | 0.28 | 2.36*** | 0.29 |
| 30–64 (reference) | 1 | | 1 | | | 1 | | | 1 | |
| 65 and older | −3.16*** | 0.37 | −3.15*** | 0.37 | −2.41*** | 0.37 | −2.36*** | 0.38 | −2.66*** | 0.38 |
| Alcohol consumption | | | | | | | | | | |
| Light (< 0.257 ounces) (reference) | 1 | | 1 | | 1 | | 1 | | 1 | |
| Moderate (> 0.0257 to 1.2 ounces) | 1.10*** | 0.27 | 1.11*** | 0.27 | 0.77** | 0.27 | 0.76** | 0.27 | 0.72* | 0.27 |
| Heavy (> 1.2 ounces) | 0.95* | 0.42 | 0.95* | 0.42 | 0.73 | 0.40 | 0.67 | 0.41 | 0.68 | 0.41 |
| Current smoker vs. (no = reference) | −2.28*** | 0.31 | −2.28*** | 0.31 | −1.58*** | 0.30 | −1.60*** | 0.30 | −1.52*** | 0.30 |
| Body mass index[a] | −0.04*** | 0.01 | −0.04*** | 0.01 | −0.04*** | 0.01 | −0.04*** | 0.01 | −0.04*** | 0.01 |
| Physical activity | | | | | | | | | | |
| None (reference) | 1 | | 1 | | 1 | | 1 | | 1 | |
| Moderate | 0.14 | 0.88 | 0.14 | 0.88 | 0.54 | 0.88 | 0.59 | 0.87 | 0.53 | 0.89 |
| Vigorous | 0.55 | 0.38 | 0.55 | 0.38 | 0.66 | 0.38 | 0.68 | 0.38 | 0.77* | 0.38 |
| Cardiovascular disease | −6.54*** | 0.58 | −6.54*** | 0.58 | −6.31*** | 0.56 | −6.31*** | 0.56 | −6.20*** | 0.55 |
| Diabetes vs. (no = reference) | −5.30*** | 0.66 | −5.31*** | 0.66 | −5.09*** | 0.66 | −5.06*** | 0.66 | −5.03*** | 0.67 |
| Arthritis | | | | | | | | | | |
| Yes vs. (no = reference) | −7.01*** | 0.43 | −7.02*** | 0.43 | −6.83*** | 0.55 | −6.84*** | 0.41 | −6.73*** | 0.41 |
| Unknown vs. (no = reference) | −0.10 | 0.83 | −0.09 | 0.83 | 0.05 | 0.80 | 0.06 | 0.80 | 0.15 | 0.81 |
| Education[a] | | | | | 1.36*** | 0.21 | 1.36*** | 0.22 | 1.32*** | 0.21 |
| Personal Income[a] | | | | | 1.09*** | 0.13 | 1.11*** | 0.13 | 1.09*** | 0.13 |
| Insurance | | | | | | | | | | |
| None | | | | | | | 0.45 | 0.46 | 0.65 | 0.45 |
| Private | | | | | | | −0.26 | 0.26 | −0.25 | 0.26 |
| Public (reference) | | | | | | | 1 | | 1 | |
| Alcohol treatment utilization, yes | | | | | | | 0.96 | 1.13 | 1.55 | 1.10 |
| Stressful life events[a] | | | | | | | | | −0.26** | 0.08 |
| Racial discrimination | | | | | | | | | −0.77 | 0.48 |
| Medium (1.2 to 1.5) | | | | | | | | | | |
| High (> 1.5) | | | | | | | | | −1.04* | 0.52 |
| Alcoholism stigma[a] | | | | | | | | | −0.03* | 0.01 |
| Constant[b] (mean, *SE*) | 55.4*** (0.3) | | 55.4*** (0.3) | | 51.0*** (0.6) | | 51.0*** (0.6) | | 52.5*** (0.7) | |
| Significance of race × | | | $F(1, 65) = 5.73$ | | $F(1, 65) = 4.54$ | | $F(1, 65) = 4.66$ | | $F(1, 65) = 4.28$ | |
| AUD interaction | | | $p = .020$ | | $p = .040$ | | $p = .034$ | | $p = .043$ | |
| Variance Explained | | | $R^2 = 22.86$ | | $R^2 = 24.67$ | | $R^2 = 24.71$ | | $R^2 = 25.04$ | |

*Note.* All models were adjusted for age group, current smoker, alcohol consumption, body mass index, physical activity, diabetes, cardiovascular disease, and arthritis.

[a]Modeled as a continuous variable. [b]The constant refers to the outcome of physical and functional health status.

Model 1: Main effects

Model 2: Interaction of Race × AUD

Model 3: Model 2 + socioeconomic status

Model 4: Model 3 + health care access and alcohol treatment utilization

Model 5: Model 4 + psychosocial stressors

*$p < .05$. **$p < .01$, ***$p < .001$,

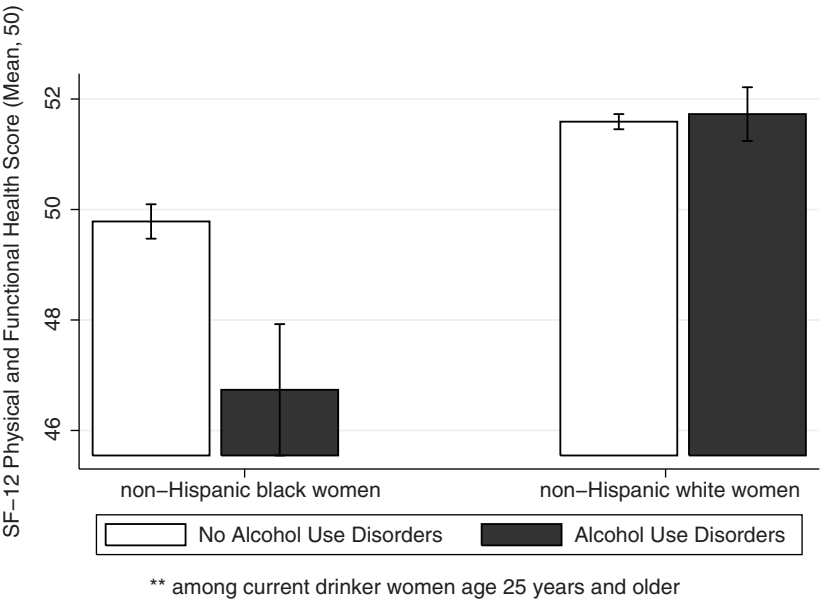


**Figure 1.** Race differences in the association between alcohol use disorders and health with standard error bars.

drinking women age 25 years and older. When race was considered as a main effect, black women had a two-point lower physical and functional health score than white women, adjusting for covariates ($\beta$ = −2.02, $SE$ = 0.31, $p$ < .001) (Model 1). AUD was not significantly associated with lower health adjusting for covariates (Model 1). However, there was a significant interaction between race and AUD associated with physical and functional health. Black women with AUD had a three-point lower health score than their white counterparts ($\beta$ = −3.18, $SE$ = 1.28, $p$ < .05) (Model 2), Wald test for interaction ($df$ = 1, 65), $F$ = 5.73, $p$ = .02). Figure 1 displays the interaction, showing the decrease in health due to AUD among black women but no differences among white women with and without AUD.

Beginning with Model 3, we assessed whether adding the hypothesized explanatory factors accounted for the interaction between race and AUD associated with physical and functional health. The addition of socioeconomic status slightly attenuated the coefficient for the race × AUD interaction ($\beta$ = −2.71, $SE$ = 1.27, $p$ < .05) (Model 3). Sequential adjustment for insurance status and alcoholism treatment utilization appeared to suppress the association that socioeconomic status had on health. Specifically, after health care factors were added, the interaction coefficient widened from the previous model, ($\beta$ = −2.77, $SE$ = 1.28, $p$ < .05) (Model 4). Adding psychosocial stressors attenuated the magnitude of the race × AUD interaction ($\beta$ = −2.64, $SE$ = 1.27, $p$ < .05) (Model 5). The reduction in the race effect of AUD on health in the interaction model compared to the model adjusting for all proposed explanatory factors was 20 percent (i.e., [3.18 – 2.64]/ 2.64 × 100).

To better understand these black-white differences in the association between AUD and health, we conducted race-specific analyses (Table 3). We found that for white women,

**Table 3.** Race-specific association of 12-month *DSM-IV* AUD in Wave 1 and physical and functional health in Wave 2 among current drinker women age 25 years and older, in the National Epidemiologic Survey of Alcohol and Related Conditions, USA ($N$ = 8,603)

| | Non-Hispanic white | | Non-Hispanic black | |
|---|---|---|---|---|
| | *b* | *SE* | *b* | *SE* |
| *DSM-IV* Alcohol use disorder (AUD) | 0.19 | 0.48 | −2.30* | 1.10 |
| Age group | | | | |
| 25–29 | 2.18*** | 0.31 | 3.93*** | 0.66 |
| 30–64 (reference) | 1 | | 1 | |
| 65 and older | −2.76*** | 0.40 | −1.86* | 0.91 |
| Alcohol consumption | | | | |
| Light (< 0.257 ounces) (reference) | 1 | | 1 | |
| Moderate (0.0257 to 1.2 ounces) | 0.80** | 0.28 | −0.01 | 0.68 |
| Heavy (> 1.2 ounces) | 0.81 | 0.45 | 0.24 | 1.18 |
| Current smoker vs. (no = reference) | −1.77*** | 0.33 | 0.69 | 0.70 |
| Body mass index[a] | −0.04*** | 0.01 | −0.05** | 0.01 |
| Physical activity | | | | |
| None (reference) | 1 | | 1 | |
| Moderate | 0.29 | 0.95 | 2.45 | 1.60 |
| Vigorous | 0.89* | 0.42 | 0.10 | 0.84 |
| Cardiovascular disease | −6.12*** | 0.59 | −7.11*** | 1.06 |
| Diabetes vs. (no = reference) | −4.96*** | 0.73 | −5.12*** | 1.29 |
| Arthritis | | | | |
| Yes vs. (no = reference) | −6.77*** | 0.44 | −6.23*** | 0.98 |
| Unknown vs. (no = reference) | −0.16 | 0.91 | 1.42 | 1.25 |
| Education[a] | 1.25*** | 0.23 | 1.49** | 0.52 |
| Income[a] | 0.98*** | 0.14 | 2.41*** | 0.36 |
| Insurance | | | | |
| None | 0.78 | 0.47 | 0.54 | 1.00 |
| Private | −0.30 | 0.27 | 0.36 | 0.63 |
| Public (reference) | 1 | | 1 | |
| Alcohol treatment utilization, yes | 1.74 | 1.23 | 0.59 | 2.22 |
| Stressful life events[a] | −0.25** | 0.09 | −0.25 | 0.14 |
| Racial discrimination | | | | |
| Medium (1.2 to 1.5) | −1.22 | 0.63 | 0.09 | 0.85 |
| High (> 1.5) | −0.73 | 0.77 | −1.40* | 0.63 |
| Alcoholism stigma[a] | −0.03* | 0.01 | −0.02 | 0.03 |
| Constant[b] (mean, *SE*) | 52.86*** | 0.77 | 49.03*** | 1.68 |

*Note.* All models were adjusted for age group, current smoker, alcohol consumption, body mass index, physical activity, diabetes, cardiovascular disease, arthritis, and proposed explanatory factors: socio-economic status, health care access and alcohol treatment utilization, and psychosocial stressors. [a]Modeled as a continuous variable. [b]The constant refers to the outcome of physical and functional health status.

*$p$ < .05. **$p$ < .01. ***$p$ < .001.

AUD was related to better physical and functional health adjusting for covariates and all the explanatory mechanisms, although not statistically significant ($\beta$ = 0.19, $SE$ = 0.48, $p$ > .05). In contrast, for black women, AUD was statistically associated with poorer physical and functional health ($\beta$ = −2.30, $SE$ = 1.10, $p$ < .05).

For white women, moderate drinking and vigorous physical activity had a positive association with physical and functional health, but this was not found among black women. Higher BMI, cardiovascular disease, and diabetes had a stronger negative association with physical and functional health for black women than for white women. Education and income had a stronger positive association with health for black than for white women.

Stressful life events had a similar magnitude of poor health association across both groups but was statistically significant only among whites. High racial discrimination had a significant negative association with health among black but not white women.

## Discussion

In this sample of current drinker non-Hispanic black and white women ages 25 years and older, there were no significant race differences in 12-month prevalence of *DSM-IV* AUD. Previous studies that investigated black-white differences in the association between alcohol and health vary in the indicators used to characterize excessive drinking, and several have used nondiagnostic measures. Methodological differences preclude a direct comparison of prevalence estimates to other studies utilizing NESARC data. Nevertheless, our findings are consistent with one other study showing that among current drinker women (age 18 years and older), there were no significant differences in the 12-month prevalence of alcohol abuse and dependence criteria between black and white women (Witbrodt et al. 2014).

We found that despite no differences in 12-month AUD prevalence, black women with AUD had poorer health than white women with AUD. Our findings that black women fare worse at similar levels of alcohol consumption is consistent with patterns found in prior research (Mulia et al. 2009). For example, Chartier, Hesselbrock, and Hesselbrock (2013) showed that among alcohol-dependent women at the same mean years of heavy drinking, black women had 0.85 point poorer chronic and physical health consequences, while the association of drinking and poor health was 0.11 point lower for white women.

Racial disparities in the association between AUD and health persisted beyond health status and lifestyle controls, which included heavy alcohol consumption, physical inactivity, and high BMI. Our estimates of black-white disparities may be underestimated given that those excluded from the multivariable analysis were more likely to be black, have higher stress, and experience lower discrimination.

Socioeconomic status influenced but did not entirely attenuate the race effect of AUD on physical and functional health. Higher socioeconomic status is associated with better physical and functional health (Matthews and Gallo 2011) and better access to resources (Link and Phelan 1996) such as alcohol treatment utilization (Saunders, Zygowicz, and D'Angelo 2006). Prior studies have also showed that race effects on some major fatal chronic diseases are not eliminated after socioeconomic status is adjusted (Hayward et al. 2000).

It still remains unclear, however, whether the reason that socioeconomic status did not attenuate race differences in alcohol and health is because the race effect could be due to residual confounding between high socioeconomic status and good health practices (Williams 2012). For instance, there is some evidence of a positive association between AUD and physical activity; however, the protective association diminishes with more severe forms of AUD (e.g., dependence) (Lisha, Sussman, and Leventhal 2013), which in turn may limit physical and functional health. One national study showed that compared to white women current drinkers, black women current drinkers had an almost three-fold higher risk of meeting three or more *DSM-IV* dependence criteria, adjusting for heavy episodic drinking (Witbrodt et al. 2014). While there were no racial differences in AUD prevalence or physical activity in our study, the wider body of evidence suggests that

further research into lifestyle factors could be useful to understand racial disparities in AUD and health.

Empirical evidence has documented that alcohol abuse—one component of AUD—is biased towards those with higher socioeconomic status (Keyes and Hasin 2008). Our results indicate little support for the hypothesis of better health being related to higher socioeconomic status among white women. In fact, we find that in race-specific models, socioeconomic status had a larger magnitude of association with better health among black than among white women. We examined only education and income in this study. Other socioeconomic measures such as occupational status and wealth also have profound impacts on health (Williams et al. 2010). Therefore, investigating other markers of socioeconomic status is one direction for future research on this topic.

Racial disparities in the association between AUD and health remained, and slightly widened, after additional adjustments for health care access and alcohol treatment utilization. This finding may reflect the extremely low levels of alcohol treatment in this sample. For instance, one study estimated that 15 percent of persons in the US population with AUD received some alcohol treatment (Cohen et al. 2007). In this study, less than 2 percent of the sample reported any treatment for AUD, and this low percentage was similar for both black and white women.

In the pooled data, additionally adjusting for stressful life events, racial discrimination, and alcoholism stigma further attenuated racial disparities, which may indicate that psychosocial factors are modest predictors of health disparities (Schnittker 2004). However, in race-specific models, racial discrimination was a significant determinant of poor health among black but not white women. This finding could be explained potentially by racial differences in the relationship between discrimination and alcohol use. For instance, one large national multiethnic study found that higher racial/ethnic discrimination was statistically associated with higher odds of heavy drinking among blacks but lower nonsignificant odds among whites (Borrell et al. 2010). We also found that AUD in Wave 1 was significantly associated with poorer health in Wave 2 among black women, and the association was reversed, although not significant, among whites. Some research suggests that blacks engage in unhealthy behaviors such as alcohol misuse to cope with stress, which can buffer mental health in the short term but ultimately contribute to poorer physical and chronic health conditions in the long run (Jackson and Knight 2006; Jackson, Knight, and Rafferty 2010).

This study has some limitations. The NESARC sample is based on households, hence our study is not applicable to clinical or institutional samples. Evidence suggests that in clinical samples, AUD prevalence is higher among blacks, and that black-white disparities in alcohol and health are pronounced (Williams et al. 2012, 2016). However, NESARC is the largest probability survey on alcohol, psychiatric, and psychosocial mechanisms in the US. Therefore, findings from this research are potentially generalizable to the wider US population of current drinker black and white women age 25 years and older. Both AUD and physical and functional health were assessed by self-report, and the extent to which social desirability bias could have affected our estimates is unknown.

Another limitation is that the minimum score to detect clinically important differences between the SF-12 and chronic disease outcomes is not well known, and in some cases the SF-12 failed to detect disease differences in diabetes compared to other physical and functional health measures (Johnson and Maddigan 2004)—partially a function of

limitations with the SF-12 weighting procedures used for the multiple subscales of the measure (Busija et al. 2011). Such limitations may thwart the ability to suggest clinical interventions based on this study without additional research linking physical and functional health to other chronic disease outcomes or biomarker indicators of health. Notwithstanding, the SF-12 is not disease-specific and can be used to represent a broad range of health conditions (Busija et al. 2011); this property makes it a robust measure to compare across groups, especially since the psychometric properties have been shown to be strong for African Americans (Larson et al. 2008).

The longitudinal analysis of these data allowed us to strengthen the causal claims of race differences in the effect of AUD on physical and functional health, something that previous studies lacked. We found strong evidence that the long-term impact on health attributed to AUD is worse for black than for white women. Because NESARC has a large sample size, our analyses avoided some of the problems, such as low precision, that have plagued racial disparities research (Griffith, Neighbors, and Johnson 2009). Importantly, we moved beyond the basic documenting of black-white differences in AUD and health by investigating factors that traditionally account for racial disparities that have not been systematically examined in prior research on this topic.

## Conclusion

Reducing adverse health outcomes attributed to excessive alcohol use and eliminating racial disparities in health attributed to alcohol are Healthy People 2020 objectives (United States Department of Health and Human Services 2015). Based on the results from this one study, we found about a 20 percent reduction in race effects in the association between AUD and physical and functional health among black and white women current drinkers age 25 years and older. We suggest that future research examine additional mechanisms beyond socioeconomic status and psychosocial factors, particularly among women. Specifically, we suggest investigating contextual level factors such as racial residential segregation, alcohol exposure and availability in the community, and income inequality (Elgar et al. 2005; Theall et al. 2011; Williams and Collins 2001). Future research should also examine black-white differences in AUD and biological markers of health such as interleukin-6 (IL-6), which drives poor health through pathways of inflammation caused by heavy alcohol use (Agarwal and Seitz 2001). Research using biological markers of health can provide a deeper insight into the physiological pathways through which alcohol interacts with organ systems to produce disparities in other health conditions, including hypertension and other cardiovascular diseases that are top causes of mortality among blacks in the US.

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## References


Agarwal, D., and H. K. Seitz, eds. 2001. *Alcohol in health and disease*. New York, NY: Marcel Dekker.

Alvanzo, A. A. H., C. L. Storr, L. La Flair, K. M. Green, F. A. Wagner, and R. M. Crum. 2011. Race/ethnicity and sex differences in progression from drinking initiation to the development of alcohol dependence. *Drug and Alcohol Dependence* 118 (2):375–82. doi:10.1016/j.drugalcdep.2011.04.024.

American Psychiatric Association. 2000. *Diagnostic and statistical manual of mental disorders*. 4th ed., text revision ed. Washington, DC: Author.

Baraona, E., C. S. Abittan, K. Dohmen, M. Moretti, G. Pozzato, Z. W. Chayes, C. Schaefer, and C. S. Lieber. 2001. Gender differences in pharmacokinetics of alcohol. *Alcoholism, Clinical and Experimental Research* 25 (4):502–07. doi:10.1111/j.1530-0277.2001.tb02242.x.

Borrell, L. N., A. V. Diez Roux, D. R. Jacobs, Jr., S. Shea, S. A. Jackson, S. Shrager, and R. S. Blumenthal. 2010. Perceived racial/ethnic discrimination, smoking and alcohol consumption in the Multi-Ethnic Study of Atherosclerosis (MESA). *Preventive Medicine* 51 (3–4):307–12. doi:10.1016/j.ypmed.2010.05.017.

Bouchery, E. E., H. J. Harwood, J. J. Sacks, C. J. Simon, and R. D. Brewer. 2011. Economic costs of excessive alcohol consumption in the US, 2006. *American Journal of Preventive Medicine* 41 (5):516–24. doi:10.1016/j.amepre.2011.06.045.

Burdine, J. N., M. R. Felix, A. L. Abel, C. Wiltraut, and Y. Musselman. 2000. The SF-12 as a population health measure: An exploratory examination of potential for application. *Health Services Research* 35 (4):885–904.

Busija, L., E. Pausenberger, T. P. Haines, S. Haymes, R. Buchbinder, and R. H. Osborne. 2011. Adult measures of general health and health-related quality of life: Medical Outcomes Study Short Form 36-Item (SF-36) and Short Form 12-Item (SF-12) Health Surveys, Nottingham Health Profile (NHP), Sickness Impact Profile (SIP), Medical Outcomes Study Short Form 6D (SF-6D), Health Utilities Index Mark 3 (HUI3), Quality of Well-Being Scale (QWB), and Assessment of Quality of Life (AQOL). *Arthritis Care and Research* 63 (S11):S383–S412. doi:10.1002/acr.20541.

Centers for Disease Control and Prevention. 2011. *Excessive alcohol use: Addressing a leading risk for death, chronic disease, and injury*. National Center for Chronic Disease Prevention and Health Promotion. April 12, 2011. http://www.cdc.gov/chronicdisease/resources/publications/aag/pdf/2011/alcohol_aag_web_508.pdf (accessed December 10, 2013).

Chartier, K. G., M. N. Hesselbrock, and V. M. Hesselbrock. 2013. Ethnicity and gender comparisons of health consequences in adults with alcohol dependence. *Substance Use & Misuse* 48:200–01. doi:10.3109/10826084.2013.747743.

Cohen, E., R. Feinn, A. Arias, and H. R. Kranzler. 2007. Alcohol treatment utilization: Findings from the National Epidemiologic Survey on Alcohol and Related Conditions. *Drug and Alcohol Dependence* 86 (2–3):214–21. doi:10.1016/j.drugalcdep.2006.06.008.

Dawson, D. A. 2000. Drinking patterns among individuals with and without DSM-IV alcohol use disorders. *Journal of Studies on Alcohol* 61 (1):111–20. doi:10.15288/jsa.2000.61.111.

Dawson, D. A. 2011. Defining risk drinking. *Alcohol Research and Health* 34 (2):144–56.

Dawson, D. A., B. F. Grant, and W. J. Ruan. 2005. The association between stress and drinking: Modifying effects of gender and vulnerability. *Alcohol and Alcoholism* 40 (5):453–60. doi:10.1093/alcalc/agh176.

Dressler, W. W., K. S. Oths, and C. C. Gravlee. 2005. Race and ethnicity in public health research: Models to explain health disparities. *Annual Review of Anthropology* 34 (1):231–52. doi:10.1146/annurev.anthro.34.081804.120505.

Elgar, F. J., C. Roberts, N. Parry-Langdon, and W. Boyce. 2005. Income inequality and alcohol use: A multilevel analysis of drinking and drunkenness in adolescents in 34 countries. *European Journal of Public Health* 15 (3):245–50. doi:10.1093/eurpub/cki093.

Fleishman, J. A., and W. F. Lawrence. 2003. Demographic variation in SF-12 scores: True differences or differential item functioning? *Medical Care* 41 (7):III-75–III-86. doi:10.1097/01.MLR.0000076052.42628.CF.

Friedman, E. M., S. L. Christ, and D. K. Mroczek. 2015. Inflammation partially mediates the association of multimorbidity and functional limitations in a national sample of middle-aged and older adults: The MIDUS Study. *Journal of Aging and Health* 27 (5):843–63. doi:10.1177/0898264315569453.

Fuchs, F. D., L. E. Chambless, A. R. Folsom, M. L. Eigenbrodt, B. B. Duncan, A. Gilbert, and M. Szklo. 2004. Association between alcoholic beverage consumption and incidence of coronary heart disease in Whites and Blacks: The Atherosclerosis Risk in Communities Study. *American Journal of Epidemiology* 160 (5):466–74. doi:10.1093/aje/kwh229.

Glass, J. E., S. D. Kristjansson, and K. K. Bucholz. 2013. Perceived alcohol stigma: Factor structure and construct validation. *Alcoholism, Clinical and Experimental Research* 37 (1):E237–E246. doi:10.1111/j.1530-0277.2012.01887.x.

Godette, D. C., S. Headen, and C. L. Ford. 2006. Windows of opportunity: Fundamental concepts for understanding alcohol-related disparities experienced by young blacks in the United States. *Prevention Science* 7 (4):377–87. doi:10.1007/s11121-006-0044-3.

Grant, B. F., and D. A. Dawson. 2006. Introduction to the National Epidemiologic Survey on Alcohol and Related Conditions. *Alcohol Health and Research World* 29 (2):74–78.

Grant, B. F., D. A. Dawson, F. S. Stinson, S. P. Chou, M. C. Dufour, and R. P. Pickering. 2004. The 12-month prevalence and trends in DSM-IV alcohol abuse and dependence: United States, 1991–1992 and 2001–2002. *Drug and Alcohol Dependence* 74 (3):223–34. doi:10.1016/j.drugalcdep.2004.02.004.

Grant, B. F., T. C. Harford, D. A. Dawson, P. S. Chou, and R. P. Pickering. 1995. The Alcohol Use Disorder and Associated Disabilities Interview Schedule (AUDADIS): Reliability of alcohol and drug modules in a general population sample. *Drug and Alcohol Dependence* 39 (1):37–44. doi:10.1016/0376-8716(95)01134-K.

Grant, J. D., A. Vergés, K. M. Jackson, T. J. Trull, K. J. Sher, and K. K. Bucholz. 2011. Age and ethnic differences in the onset, persistence and recurrence of alcohol use disorder. *Addiction* 107 (4):756–65. doi:10.1111/j.1360-0443.2011.03721.x.

Griffin, K. W., L. M. Scheier, G. J. Botvin, and T. Diaz. 2000. Ethnic and gender differences in psychosocial risk, protection, and adolescent alcohol use. *Prevention Science* 1 (4):199–212. doi:10.1023/A:1026599112279.

Griffith, D. M., H. W. Neighbors, and J. Johnson. 2009. Using national data sets to improve the health and mental health of Black Americans: Challenges and opportunities. *Cultural Diversity & Ethnic Minority Psychology* 15 (1):86–95. doi:10.1037/a0013594.

Hasin, D., K. M. Carpenter, S. McCloud, M. Smith, and B. F. Grant. 1997. The Alcohol Use Disorder and Associated Disabilities Interview Schedule (AUDADIS): Reliability of alcohol and drug modules in a clinical sample. *Drug and Alcohol Dependence* 44 (2–3):133–41. doi:10.1016/S0376-8716(97)01332-X.

Hasin, D. S., F. S. Stinson, E. Ogburn, and B. F. Grant. 2007. Prevalence, correlates, disability, and comorbidity of DSM-IV alcohol abuse and dependence in the United States: Results from the National Epidemiologic Survey on Alcohol and Related Conditions. *Archives of General Psychiatry* 64 (7):830–42. doi:10.1001/archpsyc.64.7.830.

Hayward, M. D., T. P. Miles, E. M. Crimmins, and Y. Yang. 2000. The significance of socio-economic status in explaining the racial gap in chronic health conditions. *American Sociological Review* 65 (6):910–30. doi:10.2307/2657519.

Heeringa, S. G., B. T. West, and P. A. Berglund. 2010. *Applied survey data analysis*. Boca Raton, FL: Chapman & Hall/CRC.

Holmila, M., and K. Raitasalo. 2005. Gender differences in drinking: Why do they still exist? *Addiction* 100 (12):1763–69. doi:10.1111/j.1360-0443.2005.01249.x.

Hommer, D. W., R. Momenan, E. Kaiser, and R. R. Rawlings. 2001. Evidence for a gender-related effect of alcoholism on brain volumes. *American Journal of Psychiatry* 158 (2):198–204. doi:10.1176/appi.ajp.158.2.198.

Jackson, C. L., F. B. Hu, I. Kawachi, D. R. Williams, K. J. Mukamal, and E. B. Rimm. 2015. Black–white differences in the relationship between alcohol drinking patterns and mortality among US

men and women. *American Journal of Public Health* 105 (S3):S534–S543. doi:10.2105/AJPH.2015.302615.

Jackson, J. S., and K. M. Knight. 2006. Race and self-regulatory health behaviors: The role of the stress response and the HPA axis in physical and mental health disparities. In *Social structures, aging, and self-regulation in the elderly*, ed. W. K. Schaie and L. L. Carstensen, 189–207. New York, NY: Springer.

Jackson, J. S., K. M. Knight, and J. A. Rafferty. 2010. Race and unhealthy behaviors: Chronic stress, the HPA axis, and physical and mental health disparities over the life course. *American Journal of Public Health* 100 (5):933–39. doi:10.2105/AJPH.2008.143446.

Jarque-López, A., E. González-Reimers, F. Rodríguez-Moreno, F. Santolaria-Fernández, A. López-Lirola, R. Ros-Vilamajo, J. G. Espinosa-Villarreal, and A. Martínez-Riera. 2001. Prevalence and mortality of heavy drinkers in a general medical hospital unit. *Alcohol and Alcoholism* 36 (4):335–38. doi:10.1093/alcalc/36.4.335.

Johnson, J. A., and S. L. Maddigan. 2004. Performance of the RAND-12 and SF-12 summary scores in type 2 diabetes. *Quality of Life Research* 13 (2):449–56. doi:10.1023/B:QURE.0000018494.72748.cf.

Jones-Webb, R., C.-Y. Hsiao, P. Hannan, and R. Caetano. 1997. Predictors of increases in alcohol-related problems among black and white adults: Results from the 1984 and 1992 National Alcohol Surveys. *American Journal of Drug and Alcohol Abuse* 23 (2):281–99. doi:10.3109/00952999709040947.

Keyes, K. M., and D. S. Hasin. 2008. Socio-economic status and problem alcohol use: The positive relationship between income and the DSM-IV alcohol abuse diagnosis. *Addiction* 103 (7):1120–30. doi:10.1111/j.1360-0443.2008.02218.x.

Keyes, K. M., M. L. Hatzenbuehler, P. Alberti, W. E. Narrow, B. F. Grant, and D. S. Hasin. 2008. Service utilization differences for axis-I psychiatric and substance use disorders between White and Black adults. *Psychiatric Services* 59 (8):893–901. doi:10.1176/appi.ps.59.8.893.

Krieger, N., K. Smith, D. Naishadham, C. Hartman, and E. M. Barbeau. 2005. Experiences of discrimination: Validity and reliability of a self-report measure for population health research on racism and health. *Social Science & Medicine* 61 (7):1576–96. doi:10.1016/j.socscimed.2005.03.006.

Larson, C. O., D. Schlundt, K. Patel, M. Hargreaves, and K. Beard. 2008. Validity of the SF-12 for use in a low-income African American community-based research initiative (REACH 2010). *Preventing Chronic Disease* 5 (2):A44.

Link, B. G., and J. Phelan. 1996. Understanding sociodemographic differences in health—The role of fundamental social causes. *American Journal of Public Health* 86 (4):471–73. doi:10.2105/AJPH.86.4.471.

Lisha, N. E., S. Sussman, and A. M. Leventhal. 2013. Physical activity and alcohol use disorders. *American Journal of Drug and Alcohol Abuse* 39 (2):115–20. doi:10.1016/j.addbeh.2011.04.003.

Matthews, K. A., and L. C. Gallo. 2011. Psychological perspectives on pathways linking socio-economic status and physical health. *Annual Review of Psychology* 62:501–30. doi:10.1146/annurev.psych.031809.130711.

Mulia, N., Y. Ye, T. Greenfield, and S. E. Zemore. 2009. Disparities in alcohol-related problems among white, black, and Hispanic Americans. *Alcoholism: Clinical and Experimental Research* 33 (4):654–662.

Mulia, N., Y. Ye, S. E. Zemore, and T. K. Greenfield. 2008. Social disadvantage, stress, and alcohol use among Black, Hispanic, and White Americans: Findings from the 2005 US National Alcohol Survey. *Journal of Studies on Alcohol and Drugs* 69 (6):824–33. doi:10.15288/jsad.2008.69.824.

National Center on Addiction and Substance Abuse at Columbia University. 2006. *Women under the influence*. Baltimore, MD: Johns Hopkins University Press.

National Institute on Alcohol Abuse and Alcoholism. 2016. *Alcohol facts and statistics*. NIAAA. January 2016 http://pubs.niaaa.nih.gov/publications/AlcoholFacts&Stats/AlcoholFacts&Stats.pdf (accessed March 31, 2016).

National Institutes of Health, and National Institute on Alcohol Abuse and Alcoholism. 2010. Alcohol use and alcohol use disorders in the United States, A 3-year follow-up: Main findings

from the 2004-2005 wave 2 of the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC). In *U.S. Alcohol Epidemiologic data reference manual*. Bethesda, MD: National Institute on Alcohol Abuse and Alcoholism.

Nolen-Hoeksema, S. 2004. Gender differences in risk factors and consequences for alcohol use and problems. *Clinical Psychology Review* 24 (8):981–1010. doi:10.1016/j.cpr.2004.08.003.

O'Shaughnessy, C. V. 2014. *National spending for long-term services and supports (LTSS): The basics, 2012*. Washington, DC: National Health Policy Forum.

Pacek, L. R., R. J. Malcolm, and S. S. Martins. 2012. Race/ethnicity differences between alcohol, marijuana, and co-occurring alcohol and marijuana use disorders and their association with public health and social problems using a national sample. *American Journal on Addictions* 21 (5):435–44. doi:10.1111/j.1521-0391.2012.00249.x.

Peterson, V. J., B. Nisenholz, and G. Robinson, eds. 2003. *A nation under the influence: America's addiction to alcohol*. New York, NY: Pearson Education.

Ruan, W. J., R. B. Goldstein, S. P. Chou, S. M. Smith, T. D. Saha, R. P. Pickering, D. A. Dawson, B. Huang, F. S. Stinson, and B. F. Grant. 2008. The Alcohol Use Disorder and Associated Disabilities Interview Schedule-IV (AUDADIS-IV): Reliability of new psychiatric diagnostic modules and risk factors in a general population sample. *Drug and Alcohol Dependence* 92(1–3):27–36. doi:10.1016/j.drugalcdep.2007.06.001.

Saunders, S. M., K. M. Zygowicz, and B. R. D'Angelo. 2006. Person-related and treatment-related barriers to alcohol treatment. *Journal of Substance Abuse Treatment* 30 (3):261–70. doi:10.1016/j.jsat.2006.01.003.

Schnittker, J. 2004. Psychological factors as mechanisms for socioeconomic disparities in health: A critical appraisal of four common factors. *Social Biology* 51 (1–2):1–23. doi:10.1080/19485565.2004.9989080.

StataCorp. 2014. *Stata statistical software: Release 13.1*. College Station, TX: StataCorp.

Streissguth, A. P. 2012. Sex differences in prenatal alcohol abuse in humans. In *Gender differences in prenatal substance exposure*, ed. M. Lewis and L. Kestler, 139–54. Washington, DC: American Psychological Association.

Stringhini, S., S. Sabia, M. Shipley, E. Brunner, H. Nabi, M. Kivimaki, and S.-M. Archana. 2010. Association of socioeconomic position with health behaviors and mortality. *JAMA* 303 (12):1159–66. doi:10.1001/jama.2010.297.

Theall, K. P., B. P. Lancaster, S. Lynch, R. T. Haines, S. Scribner, R. Scribner, and V. Kishore. 2011. The neighborhood alcohol environment and at-risk drinking among African Americans. *Alcoholism, Clinical and Experimental Research* 35 (5):996–1003. doi:10.1111/j.1530-0277.2010.01430.x.

United States Department of Health and Human Services. 2008. *Alcohol: A women's health issue*. Rockville, MD: U.S. Dept. of Health and Human Services, Public Health Service, National Institutes of Health, National Institute on Alcohol Abuse and Alcoholism.

United States Department of Health and Human Services. 2015. *Healthy People 2020: Substance abuse objectives*. https://www.healthypeople.gov/2020/topics-objectives/topic/substance-abuse/objectives (accessed March 21, 2015).

Volk, R. J., J. R. Steinbauer, S. B. Cantor, and C. E. Holzer. 1997. The Alcohol Use Disorders Identification Test (AUDIT) as a screen for at risk drinking in primary care patients of different racial/ethnic backgrounds. *Addiction* 92 (2):197–206. doi:10.1111/j.1360-0443.1997.tb03652.x.

Ware, J. E., Jr., M. Kosinski, and S. D. Keller. 1996. A 12-Item Short-Form Health Survey: Construction of scales and preliminary tests of reliability and validity. *Medical Care* 34 (3):220–33. doi:10.1097/00005650-199603000-00003.

Ware, J. E., Jr., M. Kosinski, D. M. Turner-Bowker, and B. Gandek. 2002. *User's manual for the SF-12v2 health survey with a supplement documenting SF-12 health survey*. Lincoln, RI: QualityMetric Incorporated.

Williams, D. R. 1997. Race and health: Basic questions, emerging directions. *Annals of Epidemiology* 7 (5):322–33. doi:10.1016/S1047-2797(97)00051-3.

Williams, D. R. 2012. Miles to go before we sleep: Racial inequities in health. *Journal of Health and Social Behavior* 53 (3):279–95. doi:10.1177/0022146512455804.

Williams, D. R., and C. Collins. 2001. Racial residential segregation: A fundamental cause of racial disparities in health. *Public Health Reports* 116 (5):404–16. doi:10.1016/S0033-3549(04)50068-7.

Williams, D. R., and P. B. Jackson. 2005. Social sources of racial disparities in health. *Health Affairs* 24 (2):325–34. doi:10.1377/hlthaff.24.2.325.

Williams, D. R., S. A. Mohammed, J. Leavell, and C. Collins. 2010. Race, socioeconomic status, and health: Complexities, ongoing challenges, and research opportunities. *Annals of the New York Academy of Sciences* 1186 (1):69–101. doi:10.1111/j.1749-6632.2009.05339.x.

Williams, E. C., K. A. Bradley, S. Gupta, and A. H. S. Harris. 2012. Association between alcohol screening scores and mortality in black, Hispanic, and white male veterans. *Alcoholism, Clinical and Experimental Research* 36 (12):2132–40. doi:10.1111/j.1530-0277.2012.01842.x.

Williams, E. C., S. Gupta, A. D. Rubinsky, R. Jones-Webb, K. M. Bensley, J. P. Young, H. Hagedorn, E. Gifford, and A. H. S. Harris. 2016. Racial/ethnic differences in the prevalence of clinically recognized alcohol use disorders among patients from the US Veterans Health Administration. *Alcoholism, Clinical and Experimental Research* 40 (2):359–66. doi:10.1111/acer.12950.

Wilsnack, R. W., N. D. Vogeltanz, S. C. Wilsnack, and T. R. Harris. 2000. Gender differences in alcohol consumption and adverse drinking consequences: Cross-cultural patterns. *Addiction* 95 (2):251–65. doi:10.1046/j.1360-0443.2000.95225112.x.

Witbrodt, J., N. Mulia, S. E. Zemore, and W. C. Kerr. 2014. Racial/ethnic disparities in alcohol-related problems: Differences by gender and level of heavy drinking. *Alcoholism, Clinical and Experimental Research* 38 (6):1662–70. doi:10.1111/acer.12398.

World Health Organization. 2011. *Global status report on alcohol and health*. Geneva, Switzerland: WHO.

Zapolski, T. C. B., S. L. Pedersen, D. M. McCarthy, and G. T. Smith. 2014. Less drinking, yet more problems: Understanding African American drinking and related problems. *Psychological Bulletin* 140 (1):188–223. doi:10.1037/a0032113.

Zemore, S. E., R. D. Murphy, N. Mulia, P. A. Gilbert, P. Martinez, J. Bond, and D. L. Polcin. 2014. A moderating role for gender in racial/ethnic disparities in alcohol services utilization: Results from the 2000 to 2010 National Alcohol Surveys. *Alcoholism* 38 (8):2286–96. doi:10.1111/acer.12500.