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Alcohol use among Native Americans compared to whites: Examining the veracity of the ‘Native American elevated alcohol consumption’ belief

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ABSTRACT

Background: This study uses national survey data to examine the veracity of the longstanding belief that, compared to whites, Native Americans (NA) have elevated alcohol consumption.

Methods: The primary data source was the National Survey on Drug Use and Health (NSDUH) from 2009 to 2013: whites ($n=171,858$) and NA ($n=4,201$). Analyses using logistic regression with demographic covariate adjustment were conducted to assess differences in the odds of NA and whites being alcohol abstinent, light/moderate drinkers (no binge/heavy consumption), binge drinkers (5+ drinks on an occasion 1–4 days), or heavy drinkers (5+ drinks on an occasion 5+ days) in the past month. Complementary alcohol abstinence, light/moderate drinking and excessive drinking analyses were conducted using Behavioral Risk Factor Surveillance System (BRFSS) data from 2011 to 2013: whites ($n=1,130,658$) and NA ($n=21,589$).

Results: In the NSDUH analyses, the majority of NA, 59.9% (95% CI: 56.7–63.1), abstained, whereas a minority of whites, 43.1% (CI: 42.6–43.6), abstained—adjusted odds ratio (AOR): 0.64 (CI: 0.56–0.73). Approximately 14.5% (CI: 12.0–17.4) of NA were light/moderate-only drinkers, versus 32.7% (CI: 32.2–33.2) of whites (AOR: 1.90; CI: 1.51–2.39). NA and white binge drinking estimates were similar—17.3% (CI: 15.0–19.8) and 16.7% (CI: 16.4–17.0), respectively (AOR: 1.00; CI: 0.83–1.20). The two populations’ heavy drinking estimates were also similar—8.3% (CI: 6.7–10.2) and 7.5% (CI: 7.3–7.7), respectively (AOR: 1.06; CI: 0.85–1.32). Results from the BRFSS analyses generally corroborated those from NSDUH.

Conclusions: In contrast to the ‘Native American elevated alcohol consumption’ belief, Native Americans compared to whites had lower or comparable rates across the range of alcohol measures examined.

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1. Introduction

It is commonly believed that Native Americans (NA) have elevated alcohol consumption compared to whites (Miheesuah, 1996). This could bear on NA healthcare, as negative beliefs about a group can compromise their interactions with healthcare providers (Betancourt and Ananeh-Firempong, 2004; Burgess et al., 2010; Smedley et al., 2003). Moreover, if such elevated consumption

exists, it might help explain why NA alcoholic liver disease (ALD) mortality was recently reported as 4.9 times that experienced by whites (Landen et al., 2014). If, however, such consumption was nonexistent, explanation for the reported disparity in NA ALD mortality would rest with factors beyond alcohol use alone (cf. Mendenhall et al., 1989; Scott and Garland, 2008). The present study uses US national survey data to compare alcohol consumption among NA and whites.

1.1. Historical and current commentary

Statements about pronounced alcohol use among NA are centuries old. For example, Leland (1976) reports that the Catholic priest Abbé Belmont, around the late 1700s, described the Ottawa as ‘passionately attached’ to brandy. In an 1847 US government report, ethnologist H. R. Schoolcraft stated “It is strange how all the

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Indian nations, and almost every person among them, male and female, are infatuated with the love of strong drink. They know no bounds to their desire” (Leland, 1976; Schoolcraft, 1847).

Today, statements about pronounced alcohol use among NA continue. For example, the Indian Health Services states that “The high rates of alcohol and substance abuse . . . in American Indian and Alaska Native (AI/AN) communities are well documented” (Indian Health Service, 2015). And the American Psychiatric Association states that “Native Americans use and abuse alcohol . . . at higher rates, than all other ethnic groups” (American Psychiatric Association, 2014).

1.2. Related research

When authorities describe NA as having a higher rate of alcohol use/abuse, it seems reasonable to assume that they, at a minimum, mean higher in comparison to whites, the United States’ largest and predominant race/ethnicity (Phinney, 1996; Population Division, 2013). This said, little research to date has actually tested whether alcohol consumption among NA as a population exceeds that of whites. Several studies have provided and/or discussed important information about drinking rates and patterns among NA in particular tribes or geographic areas (e.g. Beals et al., 2003; Beauvais, 1998; May and Gossage, 2001; Miller et al., 2012; Stanley et al., 2014). Such studies, however, have focused on selected subgroups of NA and, consequently, are not a viable basis for comparing population level alcohol consumption among NA and whites (cf. Young and Joe, 2009).

The US government conducts surveys that measure alcohol use in national samples of NA, whites and other racial/ethnic groups; for example, the National Survey on Drug Use and Health (NSDUH; Center for Behavioral Health Statistics and Quality, 2014a) and the Behavioral Risk Factor Surveillance System (BRFSS; Centers for Disease Control and Prevention, 2014). NSDUH measures heavy drinking (defined by NSDUH as 5+ drinks on an occasion 5+ different days in the past month), but we know of no studies that have tested whether such drinking differs significantly between NA and whites. At least one study (Kanny et al., 2013) has used BRFSS to compare NA to whites regarding excessive drinking (5+ drinks for men and 4+ drinks for women on an occasion 1+ times in the past month); they found it to be significantly higher among whites.

The US government has used NSDUH data to test for differences in binge drinking between the NA population and the US general population, and found significantly higher binge drinking rates among NA (Office of Applied Studies, 2010). However, the US general population is a mix of racial/ethnic groups, making it difficult to determine what the comparison means, especially as some racial/ethnic groups (e.g., Asians) in the US general population have particularly low rates of alcohol consumption (Esser et al., 2014).

The US government does provide annual descriptive estimates of binge and heavy drinking among NA and whites (and other racial/ethnic groups). For example, for NA and whites in NSDUH in 2013, the Center for Behavioral Health Statistics and Quality (2014a) reported heavy drinker (5+ drinks on an occasion 5+ days in past month) estimates of 5.8% and 7.3%, respectively, and binge drinker (5+ drinks on an occasion 1–4 days in past month) estimates of 17.7% and 16.7%, respectively. In a report for the National Institute on Alcohol Abuse and Alcoholism, Chen et al. (2006) examined the National Epidemiologic Survey on Alcohol and Related Conditions (2001–2002) and reported “heavier drinker” rates (2+ drinks per day for men and 1+ per day for women) of 12.75% and 11.29% for NA and whites, respectively. Tests on whether the above estimates for NA and whites differed by more than chance were not presented, but the estimates appear to suggest little difference.

1.3. Study approach

To help assess the veracity of the NA elevated alcohol consumption belief, this study examines, for NA and whites, drink counts during various occasions, including the most recent and typical drinking occasions. And it assesses alcohol abstinence, light/moderate drinking, binge drinking and heavy drinking. Racial/ethnic groups in addition to NA and whites are considered in selected analyses. The principal data examined come from NSDUH, reportedly the nation’s primary source for measures of drug use (Center for Behavioral Health Statistics and Quality, 2014a). Selected complementary analyses are conducted using BRFSS data to help assess possible corroboration of and expand on this study’s NSDUH analysis.

2. Methods

2.1. NSDUH

NSDUH uses complex sampling to provide representative samples of civilian, non-institutionalized individuals aged 12+ years living in the United States. Most questions in NSDUH are administered with Audio Computer-Assisted Self-Interviewing (ACASI) to provide the respondent with a highly private and confidential mode for answering questions, which can help support honest reporting of drug use (Center for Behavioral Health Statistics and Quality, 2014a,b; Mullany et al., 2013). To identify race/ethnicity, NSDUH first asks respondents whether they are Hispanic, and then which racial group best describes them: white, black/African American, American Indian/Alaska Native (referred to as NA here), Asian, or Native Hawaiian/Other Pacific Islander (NHOP). More than one race can be selected. In this study, whites are those who identified themselves as non-Hispanic white. NA, blacks, Asians, and NHOP are those who identified themselves as non-Hispanic and selected only the category NA, black/African American, Asians, or NHOP, respectively, as their race. “Multiple races” are non-Hispanics who selected more than one race. Hispanics are persons who indicated that they were Hispanic, regardless of racial group selection(s) (Center for Behavioral Health Statistics and Quality, 2014a). NSDUH makes available an imputed race/ethnicity variable (Center for Behavioral Health Statistics and Quality, 2014b); it was used here. To help ensure adequate sample sizes, we pooled NSDUH data from 2009 to 2013.

2.2. BRFSS

BRFSS, a complex sampling health survey that includes alcohol questions, is telephone-based (landline and cellular) and administered primarily with Computer Assisted Telephone Interviewing (CATI) systems. Respondents are 18+ years of age living in the United States. The Centers for Disease Control and Prevention supports BRFSS, though individual US states/territories generally oversee execution of the survey within their respective geographic areas. BRFSS asks respondents to identify their race/ethnicity much as NSDUH does. It also provides an imputed race/ethnicity variable for analysis, but the variable lacked a distinct category for NHOP (Behavioral Risk Factor Surveillance System, 2014). We consequently used BRFSS’ non-imputed race/ethnicity variable, which did include the category. BRFSS changed its sampling design in 2011, limiting comparisons with prior years (Centers for Disease Control and Prevention, 2014). This study pools BRFSS data from 2011 to 2013.

2.3. Alcohol consumption variables

All of the alcohol variables examined involve consumption in the past month. For the NSDUH analyses, abstinence was defined as no alcohol use (in the past month). Heavy drinking was 5+ drinks on the same occasion (the same time or within a couple of hours of each other) on each of 5+ days (NSDUH’s definition). “Binge but not heavy drinking”, referred to here simply as “binge drinking”, was 5+ drinks on the same occasion on 1–4 days (NSDUH’s definition). Two limited-drinking variables (not mutually exclusive of one another) were used. One was for drinkers who reported no binge or heavy drinking—labeled here as “light/moderate-only” drinkers. The other entailed persons that typically, but not necessarily always, engaged in light/moderate drinking. Persons who reported 1–4 drinks during a typical drinking occasion were included in this latter variable—labeled here as “typically-light/moderate” drinkers. Drink counts during the most recent drinking occasion and a typical drinking occasion were also examined.

For the BRFSS analyses, abstinence was also defined as no alcohol use (in the past month). BRFSS has no “binge but not heavy drinking” variable and no “heavy drinking” variable, as defined by NSDUH. BRFSS does have a variable titled “binge drinking”, defined as 5+ drinks for men and 4+ drinks for women on an occasion 1+ times in the past month. Here, this BRFSS variable is referred to as “excessive drinking”. Drinkers who reported 1–4 drinks on a typical drinking occasion were classified as typically-light/moderate drinkers. Drink counts during a typical

drinking occasion and the occasion when respondents consumed the maximum number of drinks in the past month were examined. The number of occasions that involved excessive drinking was examined as well.

2.4. Statistical analysis

Analyses were performed using Stata: Release 14 (StataCorp, 2015) complex samples procedures. Logistic regressions with statistical controls (adjustments) for age, education, income and gender were used to model the association of race/ethnicity with being a (1) alcohol abstainer, (2) light/moderate-only drinker, (3) binge drinker and (4) heavy drinker in the past month. Note that age, education, income and gender have all been found to be associated with alcohol consumption (Moore et al., 2005); and NA and whites differ regarding age, education and income (Population Division, 2013; United States Census Bureau, 2011, 2012a,b). Zero-inflated negative binomial regression with statistical controls for gender, age, education and income was used to model the association between race/ethnicity and the number of excessive drinking occasions during the past month.

Independent variables in the regression equations were dummy coded. Some BRFSS variables, for example, income, had substantial amounts of missing data (Behavioral Risk Factor Surveillance System, 2014). To help address this, missing values were assigned to an other/unknown category that was included with selected independent variables in this study's BRFSS regression analyses (Cohen et al., 2003).

3. Results

3.1. NSDUH and BRFSS sample sizes per race/ethnicity

The NSDUH sample included 4,201 NA, 171,858 white, 47,219 Hispanic, 36,336 black, 10,620 Asian, 1,385 NHOPI, and 9,753 multiple-race respondents. The BRFSS sample included 21,589 NA, 1,130,658 white, 111,642 Hispanic, 119,856 black, 28,237 Asian, 4,907 NHOPI, and 27,247 multiple-race respondents (and 29,535 respondents whose race/ethnicity was classified as other/don't know/not sure). Hereon, all data were weighted.

3.2. Descriptive estimates: demographics

NA compared to whites tended to be younger (Table 1). For example, in NSDUH, 16.8% of NA were 18–25 years of age versus 11.7% of whites; in BRFSS, 14.4% of NA were 18–24 years of age versus 11.1% of whites. Whites had more formal education and higher family income than did NA and all other racial/ethnic groups in Table 1 excepting Asians.

3.3. Descriptive estimates: drink counts

The number of drinks consumed during the most recent, typical, and maximum-drinks occasions are shown for NA and whites in Fig. 1. Regardless of the occasion type considered, pronounced differences between NA and whites seem to be apparent only in the lower part of the drink count range. NA compared to whites reported substantially higher levels of abstinence in the past month (zero drinks). Whites compared to NA reported substantially higher levels of 1–3 drinks. The percentages of NA and whites that reported larger (4+) numbers of drinks appear to be generally comparable. For both NA and whites during a typical occasion, the percentage reporting 1 drink was higher in BRFSS than in NSDUH. NA and white drink counts for the same occasions are shown in expanded detail in Supplementary material Fig. S1.

3.4. Descriptive estimates: drinker categories

Descriptive estimates of drinker types (heavy, binge, excessive, light/moderate-only and typically-light/moderate) and alcohol abstainers are shown by race/ethnicity in Table 2. NA and white heavy drinker estimates differed by less than 1 percentage point; NA and white binge drinker estimates differed by less than one percentage point; and NA and white excessive drinker estimates differed by less than one percentage point. Compared to the

other racial/ethnic groups, NA and whites had the highest descriptive estimates for heavy drinkers. But multiple other racial/ethnic groups, compared to NA and whites, had higher descriptive binge and excessive drinker estimates.

In NSDUH, light/moderate-only drinking was reported by 14.5% of NA, less than half that reported by whites—32.7%; and about one-fourth of NA (24.7%) reported typically-light/moderate drinking versus 46.5% of whites. In BRFSS, differences between NA and whites regarding typically-light/moderate drinking were roughly similar to those from NSDUH. Descriptively, whites reported more light/moderate-only and typically-light/moderate drinking than did any other racial/ethnic group in Table 2.

In NSDUH, the majority of NA (59.9%) abstained from alcohol in the past month, whereas a minority of whites (43.1%) did. BRFSS indicated a similar pattern. Descriptively, compared to whites, every other racial/ethnic group in Table 2 reported greater abstinence.

3.5. Regression analyses: race/ethnicity and drinker categories

Statistically significant differences between NA and whites regarding being a heavy drinker were not indicated (Table 3). The adjusted odds ratio (AOR) for whites versus NA in the heavy drinker logistic regression was 1.06 (Confidence Interval [CI]: 0.85, 1.32). NA had significantly higher odds of being a heavy drinker than did Hispanics, blacks and Asians.

Significant differences between NA and whites regarding being a binge drinker were not indicated (Table 3). Asians had significantly lower odds of being a binge drinker than did NA, but no other significant racial/ethnic differences in binge drinking were indicated.

In the BRFSS excessive drinker analysis (Table 4), whites compared to NA had significantly higher odds of being an excessive drinker (see AOR). Blacks and Asians compared to NA had significantly lower odds of being excessive drinkers. The unadjusted odds ratio (UOR) for Hispanics indicated that they, compared to NA, had significantly higher odds of being an excessive drinker, but the AOR for Hispanics was not significant.

Whites compared to NA had significantly higher odds of engaging in light/moderate-only drinking (NSDUH—Table 3). Hispanics and blacks, compared to NA, also had higher odds of engaging in such drinking. (Whites compared to NA also had higher odds of typically-light/moderate drinking in both NSDUH and BRFSS—see Supplementary material Table S1.)

Compared to NA, whites had significantly lower odds of abstaining from alcohol in both NSDUH (Table 3) and BRFSS (Table 4). Also in both, Asians compared to NA had higher odds of abstaining. In BRFSS (but not NSDUH), compared to NA, Hispanics and blacks had lower odds of abstaining.

All of the control variables (covariates)—gender, age, education and income—had statistically significant associations with heavy drinking, binge drinking, excessive drinking, light/moderate-only drinking and alcohol abstinence (Tables 3 and 4).

3.6. Regression analyses: number of excessive drinking occasions

The number of excessive drinking occasions (BRFSS) in the past month for NA and whites is shown in Fig. 2; there appears to be little difference between the two groups. (BRFSS records up to 76 excessive drinking occasions during the past month.)

When testing for differences in number of excessive drinking occasions, it is important to consider that these occasions constitute count data with a large number of zeros (reports of no excessive drinking occasions). The zeros occurred because some respondents never engage in excessive alcohol consumption and because some respondents by chance did not engage in excessive alcohol

Table 1
Demographics by race/ethnicity: NSDUH and BRFSS.

	NA %	White %	Hispanic %	Black %	Asian %	NHOPI %	Multiple races %
NSDUH							
Gender							
Female	52.9	51.3	49.3	54.4	53.3	49.7	51.6
Age							
65+	12.7	19.0	7.5	11.4	9.9	8.4	14.6
50–64	22.7	25.3	15.2	21.3	19.4	20.4	18.5
35–49	22.5	23.1	26.9	24.5	28.7	27.8	19.4
26–34	14.6	12.7	19.2	15.2	18.7	16.5	13.0
18–25	16.8	11.7	17.6	15.9	13.9	17.2	17.2
12–17	10.7	8.2	13.5	11.6	9.3	9.7	17.3
Education							
College graduate	8.9	30.3	12.1	15.8	51.5	20.4	16.8
Some college	24.0	24.4	19.1	25.6	20.2	25.4	27.9
High school graduate	34.2	27.9	25.8	30.6	13.3	33.2	25.2
<High school ^a	33.0	17.4	43.0	28.0	15.1	21.0	30.1
Family income							
\$75,000+	13.8	37.4	18.2	16.8	44.6	26.7	25.2
\$50,000–74,999	12.8	18.4	13.5	14.1	16.0	17.3	15.8
\$20,000–49,999	38.5	30.1	41.7	36.2	25.2	33.2	34.1
<\$20,000	35.0	14.1	26.6	32.9	14.2	22.8	24.9
BRFSS							
Gender							
Female	48.4	51.7	49.5	53.8	49.6	48.5	51.3
Age							
65+	14.1	22.0	9.1	13.2	10.2	8.2	13.2
55–64	16.2	17.7	11.2	14.8	12.2	10.5	13.9
45–54	20.3	19.2	16.0	19.2	15.7	14.3	16.3
35–44	16.9	15.3	21.3	18.4	23.5	23.4	15.9
25–34	18.2	14.8	24.7	19.4	21.1	24.9	20.9
18–24	14.4	11.1	17.7	14.9	17.2	18.7	19.8
Education							
College graduate ^b	13.0	28.6	11.8	18.0	53.2	25.1	21.4
Some college ^b	30.7	32.1	23.3	31.9	25.6	30.8	37.2
High school graduate	34.3	29.6	26.7	32.7	16.4	34.0	27.4
<High school	22.0	9.8	38.2	17.4	4.7	10.2	13.9
Household income							
\$75,000+	15.0	33.6	11.8	15.5	43.8	26.8	24.0
\$50,000–74,999	9.6	17.1	8.7	11.6	15.2	14.4	13.5
\$20,000–49,999	38.0	33.8	38.7	38.4	25.7	35.5	36.0
<\$20,000	37.5	15.5	40.8	34.6	15.3	23.3	26.4

NA = Native American. NHOPI = Native Hawaiian/Other Pacific Islander.

^a Includes persons ages 12–17.

^b Includes technical school.

Table 2
Heavy drinkers (NSDUH), binge drinkers (NSDUH), excessive drinkers (BRFSS), light/moderate drinkers (NSDUH and BRFSS), and alcohol abstainers (NSDUH and BRFSS) in the past month by race/ethnicity.

	NA		White		Hispanic		Black		Asian		NHOPI		Multiple races	
	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)
Drinker status: Survey source														
Heavy: NSDUH	8.3	(6.7, 10.2)	7.5	(7.3, 7.7)	5.1	(4.8, 5.5)	4.3	(4.0, 4.8)	1.7	(1.4, 2.0)	6.6	(4.3, 9.9)	6.5	(5.5, 7.7)
Binge: NSDUH	17.3	(15.0, 19.8)	16.7	(16.4, 17.0)	19.0	(18.3, 19.7)	15.8	(15.1, 16.4)	10.3	(9.2, 11.4)	20.2	(14.6, 27.2)	15.0	(13.6, 16.5)
Excessive: BRFSS	17.1	(15.9, 18.3)	17.9	(17.8, 18.1)	18.6	(18.1, 19.1)	13.1	(12.7, 13.5)	11.8	(11.0, 12.7)	18.0	(15.5, 21.0)	19.8	(18.6, 21.0)
Light/Moderate-Only: NSDUH	14.5	(12.0, 17.4)	32.7	(32.2, 33.2)	18.0	(17.1, 19.0)	23.1	(22.2, 23.9)	24.9	(23.0, 26.8)	18.7	(14.4, 24.0)	26.2	(24.2, 28.4)
Typically-Light/Moderate: NSDUH	24.7	(22.3, 27.2)	46.5	(46.0, 47.1)	28.5	(27.6, 29.4)	34.8	(34.0, 35.7)	30.8	(28.6, 33.0)	32.7	(26.0, 40.3)	37.2	(35.2, 39.2)
Typically-Light/Moderate: BRFSS	30.0	(28.6, 31.4)	48.3	(48.2, 48.5)	31.5	(31.0, 32.0)	37.5	(37.0, 38.1)	37.2	(36.0, 38.3)	33.1	(30.1, 36.3)	41.7	(40.3, 43.1)
Abstainer: NSDUH	59.9	(56.7, 63.1)	43.1	(42.6, 43.6)	57.8	(56.8, 58.9)	56.8	(55.9, 57.8)	63.2	(61.0, 65.3)	54.5	(48.2, 60.7)	52.3	(50.2, 54.3)
Abstainer: BRFSS	57.5	(56.0, 59.1)	42.6	(42.5, 42.8)	54.0	(53.4, 54.5)	53.6	(53.0, 54.2)	54.2	(53.0, 55.4)	51.4	(47.9, 54.9)	46.8	(45.4, 48.2)

Excessive drinking (BRFSS) was defined as 5+ drinks for men and 4+ drinks for women on an occasion 1+ times in the past month. NA = Native American. NHOPI = Native Hawaiian/Other Pacific Islander. CI = Confidence Interval.

NSDUH data were pooled for 2009–2013. BRFSS data were pooled for 2011–2013.

consumption in the past month. Zero-inflated negative binomial (ZINB) regression can help take into consideration the processes underlying these two types of zeros (Hilbe, 2007).

Using ZINB regression, we produced a “negative binomial part” to assess the association between number of excessive drinking occasions and race/ethnicity among persons open to excessive drinking (would-be and past-month excessive drinkers), and a

Table 3
Association of being a heavy drinker, binge drinker, light/moderate-only drinker and alcohol abstainer with race/ethnicity and other demographics (NSDUH): Logistic regression.

	Heavy				Binge				Light/Moderate-Only				Abstainer			
	UOR	(95% CI)	AOR	(95% CI)	UOR	(95% CI)	AOR	(95% CI)	UOR	(95% CI)	AOR	(95% CI)	UOR	(95% CI)	AOR	(95% CI)
Race/Ethnicity																
NA (ref)	1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00	
White	0.90	(0.72, 1.14)	1.06	(0.85, 1.32)	0.96	(0.81, 1.13)	1.00	(0.83, 1.20)	2.87***	(2.31, 3.56)	1.90***	(1.51, 2.39)	0.51***	(0.44, 0.58)	0.64***	(0.56, 0.73)
Hispanic	0.60***	(0.46, 0.77)	0.53***	(0.42, 0.68)	1.12	(0.95, 1.33)	1.01	(0.84, 1.22)	1.30*	(1.04, 1.62)	1.38**	(1.10, 1.74)	0.92	(0.80, 1.06)	0.97	(0.84, 1.11)
Black	0.50***	(0.40, 0.63)	0.50***	(0.40, 0.62)	0.90	(0.75, 1.07)	0.88	(0.73, 1.07)	1.77***	(1.41, 2.22)	1.62***	(1.27, 2.05)	0.88	(0.76, 1.02)	0.96	(0.83, 1.10)
Asian	0.19***	(0.14, 0.26)	0.19***	(0.14, 0.27)	0.55***	(0.44, 0.67)	0.49***	(0.39, 0.62)	1.95***	(1.57, 2.43)	1.06	(0.84, 1.34)	1.15	(0.98, 1.34)	2.14***	(1.82, 2.52)
NHOPI	0.78	(0.48, 1.27)	0.72	(0.45, 1.16)	1.21	(0.81, 1.81)	1.09	(0.71, 1.66)	1.36	(0.92, 2.00)	1.05	(0.71, 1.57)	0.80	(0.60, 1.07)	1.06	(0.80, 1.40)
Multiple races	0.77	(0.57, 1.05)	0.84	(0.62, 1.14)	0.84	(0.69, 1.02)	0.87	(0.71, 1.08)	2.10***	(1.65, 2.67)	1.93***	(1.47, 2.54)	0.73***	(0.62, 0.86)	0.75**	(0.62, 0.89)
Gender																
Male (ref)	1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00	
Female	0.32***	(0.30, 0.34)	0.31***	(0.29, 0.33)	0.55***	(0.53, 0.57)	0.55***	(0.53, 0.58)	1.27***	(1.22, 1.31)	1.31***	(1.26, 1.35)	1.49***	(1.44, 1.54)	1.56***	(1.50, 1.62)
Age																
65+ (ref)	1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00	
50–64	2.71***	(2.21, 3.32)	2.78***	(2.26, 3.42)	2.03***	(1.82, 2.28)	1.96***	(1.75, 2.19)	1.24***	(1.14, 1.34)	1.04	(0.97, 1.13)	0.57***	(0.52, 0.61)	0.64***	(0.60, 0.69)
35–49	3.93***	(3.30, 4.69)	4.35***	(3.63, 5.20)	3.35***	(3.00, 3.73)	3.28***	(2.95, 3.65)	1.07*	(1.01, 1.14)	0.91**	(0.86, 0.97)	0.45***	(0.42, 0.48)	0.48***	(0.45, 0.51)
26–34	5.82***	(4.91, 6.90)	6.62***	(5.57, 7.88)	4.84***	(4.35, 5.39)	4.84***	(4.34, 5.39)	0.85***	(0.78, 0.92)	0.76***	(0.70, 0.82)	0.37***	(0.35, 0.40)	0.36***	(0.33, 0.39)
18–25	7.53***	(6.33, 8.95)	7.92***	(6.64, 9.45)	5.14***	(4.61, 5.73)	5.10***	(4.57, 5.68)	0.57***	(0.53, 0.61)	0.64***	(0.60, 0.69)	0.43***	(0.41, 0.46)	0.36***	(0.34, 0.39)
12–17	0.80*	(0.67, 0.95)	0.89	(0.74, 1.07)	0.87*	(0.78, 0.97)	0.89*	(0.80, 0.99)	0.13***	(0.12, 0.14)	0.28***	(0.26, 0.31)	4.48***	(4.18, 4.80)	2.60***	(2.40, 2.81)
Education																
Some college (ref)	1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00	
College graduate	0.73***	(0.68, 0.79)	0.82***	(0.75, 0.89)	0.87***	(0.82, 0.91)	0.93**	(0.88, 0.98)	1.72***	(1.64, 1.81)	1.47***	(1.39, 1.55)	0.68***	(0.65, 0.72)	0.72***	(0.68, 0.76)
High school graduate	0.96	(0.90, 1.03)	0.99	(0.93, 1.06)	0.94*	(0.90, 0.99)	0.99	(0.95, 1.04)	0.65***	(0.63, 0.68)	0.68***	(0.65, 0.71)	1.49***	(1.42, 1.56)	1.39***	(1.33, 1.46)
<High school ^a	0.55***	(0.51, 0.60)	0.90*	(0.81, 0.99)	0.59***	(0.55, 0.62)	0.90***	(0.83, 0.96)	0.22***	(0.21, 0.23)	0.38***	(0.35, 0.41)	4.15***	(3.98, 4.32)	2.13***	(2.02, 2.25)
Family income																
\$75,000+ (ref)	1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00	
\$50,000–74,999	1.00	(0.92, 1.09)	1.01	(0.92, 1.10)	0.96	(0.90, 1.02)	0.94	(0.89, 1.00)	0.70***	(0.67, 0.74)	0.81***	(0.77, 0.85)	1.42***	(1.37, 1.48)	1.30***	(1.24, 1.36)
\$20,000–49,999	0.99	(0.92, 1.06)	1.07	(0.98, 1.16)	0.93***	(0.89, 0.97)	0.92***	(0.88, 0.96)	0.49***	(0.47, 0.51)	0.66***	(0.63, 0.69)	1.96***	(1.88, 2.04)	1.55***	(1.48, 1.62)
<\$20,000	1.24***	(1.14, 1.34)	1.35***	(1.24, 1.48)	0.93**	(0.87, 0.98)	0.89***	(0.84, 0.94)	0.31***	(0.29, 0.32)	0.48***	(0.46, 0.51)	2.49***	(2.37, 2.61)	1.81***	(1.72, 1.91)

All variables were dummy coded. UOR = Unadjusted Odds Ratio. AOR = Adjusted Odds Ratio. CI = Confidence Interval. NA = Native American. NHOPI = Native Hawaiian/Other Pacific Islander.

^a Includes persons ages 12–17.

* $p \leq 0.05$.

** $p \leq 0.01$.

*** $p \leq 0.001$.

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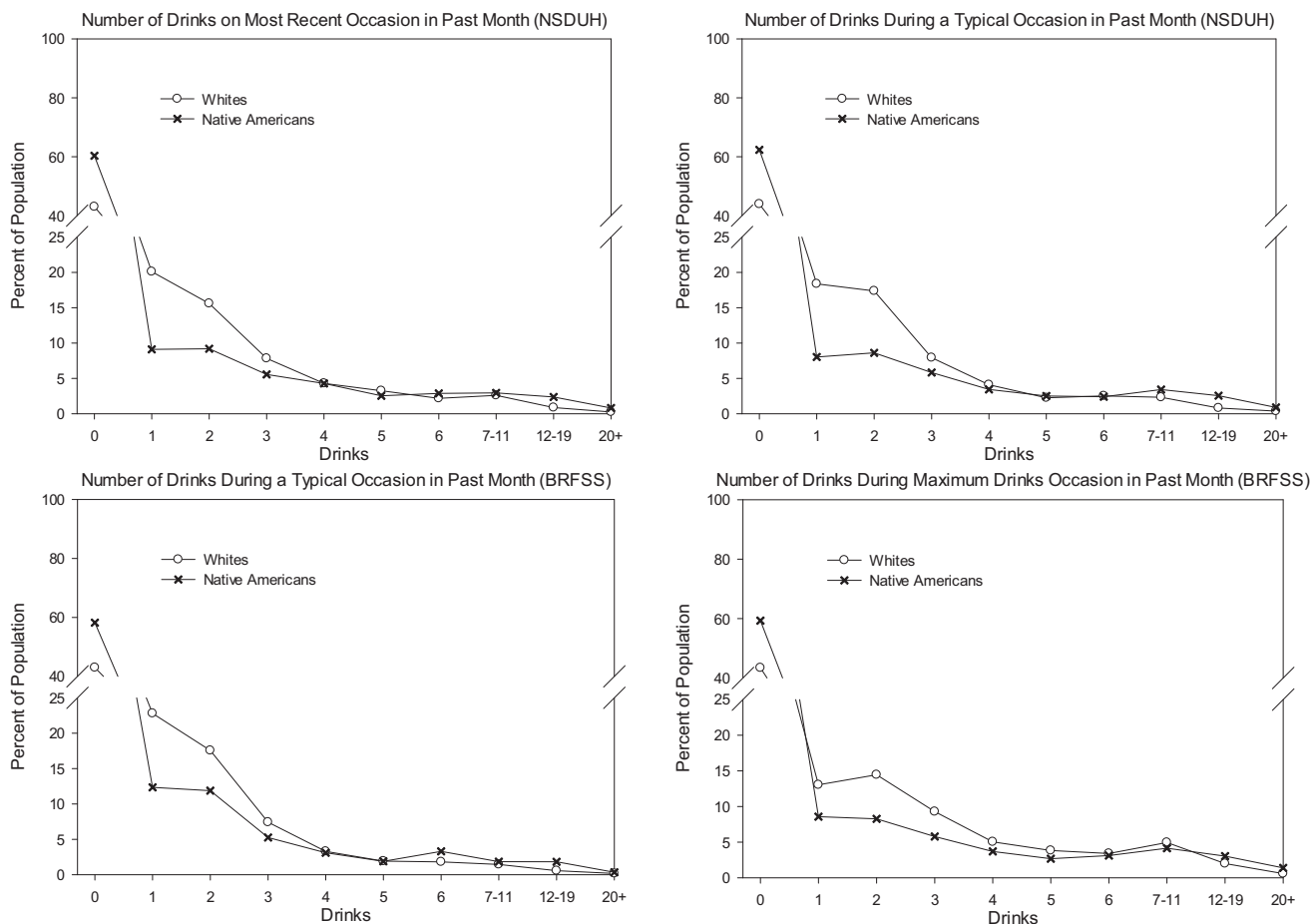


Fig. 1. Drink counts among Native Americans and whites during the most recent drinking occasion (NSDUH), a typical drinking occasion (NSDUH and BRFSS), and the occasion when the maximum number of drinks was consumed (BRFSS) in the past month.

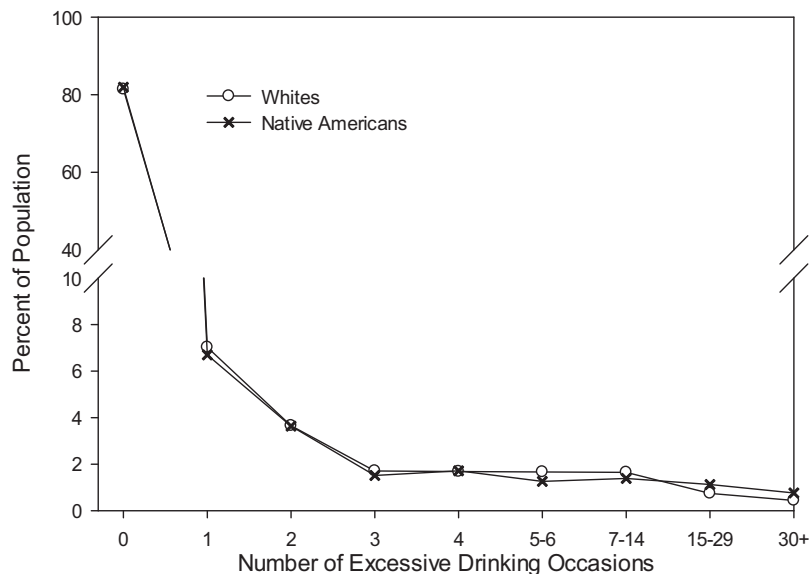


Fig. 2. Number of excessive drinking occasions in the past month among Native Americans and whites (BRFSS). Note. An excessive drinking occasion (BRFSS) was defined as one that involved 5+ drinks for men and 4+ drinks for women.

“zero-inflated part” that focused on persons not open to excessive drinking. A significant difference between NA and whites regarding number of excessive drinking occasions in the past month was not indicated; see the negative binomial part in Table 5. The analysis

did indicate that, in comparison to NA, significantly fewer excessive drinking occasions would be expected for Hispanics, blacks and Asians. Note that these findings do not apply to Hispanics, blacks and Asians in general versus NA in general; rather they apply just to

Table 4
Association of being an excessive drinker and alcohol abstainer with race/ethnicity and other demographics (BRFSS): Logistic regression.

	Excessive Drinker				Abstainer			
	UOR	(95% CI)	AOR	(95% CI)	UOR	(95% CI)	AOR	(95% CI)
Race/Ethnicity								
NA (ref)	1.00		1.00		1.00		1.00	
White	1.06	(0.97, 1.15)	1.16**	(1.06, 1.27)	0.55***	(0.52, 0.58)	0.66***	(0.62, 0.70)
Hispanic	1.11*	(1.01, 1.21)	0.97	(0.89, 1.07)	0.87***	(0.81, 0.93)	0.82***	(0.76, 0.88)
Black	0.73***	(0.66, 0.80)	0.71***	(0.64, 0.78)	0.85***	(0.80, 0.91)	0.89***	(0.83, 0.96)
Asian	0.65***	(0.58, 0.73)	0.52***	(0.46, 0.59)	0.87***	(0.81, 0.95)	1.51***	(1.39, 1.65)
NHOPI	1.07	(0.87, 1.31)	0.86	(0.70, 1.06)	0.78**	(0.67, 0.91)	1.04	(0.89, 1.22)
Multiple races	1.20**	(1.07, 1.34)	1.08	(0.96, 1.22)	0.65***	(0.60, 0.71)	0.77***	(0.70, 0.84)
Other ^a	0.85**	(0.76, 0.95)	0.89*	(0.79, 1.00)	0.75***	(0.70, 0.82)	0.83***	(0.76, 0.90)
Gender								
Male (ref)	1.00		1.00		1.00		1.00	
Female	0.43***	(0.42, 0.44)	0.45***	(0.44, 0.46)	1.70***	(1.68, 1.73)	1.68***	(1.66, 1.71)
Age								
65+ (ref)	1.00		1.00		1.00		1.00	
55–64	2.58***	(2.48, 2.68)	2.43***	(2.33, 2.53)	0.67***	(0.66, 0.68)	0.79***	(0.77, 0.80)
45–54	4.14***	(3.99, 4.31)	3.91***	(3.75, 4.06)	0.55***	(0.54, 0.56)	0.65***	(0.63, 0.66)
35–44	5.34***	(5.14, 5.55)	5.19***	(4.99, 5.41)	0.50***	(0.49, 0.52)	0.58***	(0.57, 0.60)
25–34	8.21***	(7.90, 8.53)	8.31***	(7.99, 8.64)	0.42***	(0.41, 0.43)	0.44***	(0.43, 0.45)
18–24	8.13***	(7.80, 8.49)	8.81***	(8.43, 9.21)	0.62***	(0.60, 0.64)	0.55***	(0.53, 0.56)
Education								
Some college ^b (ref)	1.00		1.00		1.00		1.00	
College graduate ^b	0.93***	(0.90, 0.95)	0.92***	(0.90, 0.95)	0.62***	(0.61, 0.64)	0.73***	(0.71, 0.74)
High school graduate	0.88***	(0.85, 0.90)	0.92***	(0.90, 0.95)	1.46***	(1.44, 1.49)	1.35***	(1.33, 1.38)
<High school	0.76***	(0.73, 0.79)	0.87***	(0.83, 0.91)	2.41***	(2.34, 2.48)	1.90***	(1.85, 1.96)
Other ^a	0.35***	(0.26, 0.47)	0.51***	(0.38, 0.70)	2.45***	(2.09, 2.88)	1.76***	(1.48, 2.08)
Household income								
\$75,000+ (ref)	1.00		1.00		1.00		1.00	
\$50,000–74,999	0.90***	(0.87, 0.92)	0.92***	(0.89, 0.95)	1.53***	(1.49, 1.57)	1.37***	(1.33, 1.40)
\$20,000–49,999	0.80***	(0.78, 0.82)	0.87***	(0.84, 0.89)	2.36***	(2.31, 2.40)	1.77***	(1.74, 1.81)
<\$20,000	0.71***	(0.69, 0.73)	0.77***	(0.75, 0.80)	3.71***	(3.63, 3.80)	2.37***	(2.31, 2.44)
Other ^a	0.51***	(0.49, 0.53)	0.56***	(0.53, 0.58)	3.33***	(3.25, 3.42)	2.32***	(2.25, 2.38)

Excessive drinking (BRFSS) was defined as 5+ drinks for men and 4+ drinks for women on an occasion 1+ times in the past month. All variables were dummy coded. UOR = Unadjusted Odds Ratio. AOR = Adjusted Odds Ratio. CI = Confidence Interval. NA = Native American. NHOPI = Native Hawaiian/Other Pacific Islander.

^a Other/don't know/not sure/refused.

^b Includes technical school.

* $p \leq 0.05$.

** $p \leq 0.01$.

*** $p \leq 0.001$.

the subsets of those populations that were open to excessive drinking (cf. Albert et al., 2014; Preisser et al., 2012). The zero-inflated part of the equation indicated that whites, compared to NA, were significantly more likely to engage in excessive drinking (see also the logistic regression for excessive drinking—Table 4).

4. Discussion

4.1. NA and whites

The majority of NA in NSDUH (59.9%) and BRFSS (57.5%) abstained from alcohol in the past month, whereas such abstinence was reported by a minority of whites, 43.1% and 42.6% in the two survey systems, respectively. About one-third of whites (32.7%) in NSDUH reported that they were light/moderate-only drinkers; whereas less than one in six NA (14.5%) reported such drinking. These differences—greater abstinence and relatively limited light/moderate alcohol use among NA—constituted the most pronounced alcohol consumption disparities between NA and whites found in the present study.

NA and white NSDUH binge drinker estimates—17.3% and 16.7%, respectively, were fairly similar; so too were their heavy drinker estimates—8.3% and 7.5%, respectively. NA and white BRFSS excessive drinker estimates—17.1% and 17.9%, respectively, were similar as well. The odds of being a binge drinker or heavy drinker (NSDUH) were not found to differ significantly between NA and whites.

Whites compared to NA, however, had significantly higher odds of being an excessive drinker (BRFSS) (cf. Kanny et al., 2013). Among NA and whites open to engaging in excessive drinking, no significant difference in the number of excessive drinking occasions in the past month (BRFSS) was indicated.

In summary, regardless of whether the variable examined was alcohol abstainers, light/moderate drinkers, binge drinkers, heavy drinkers, excessive drinkers or counts of excessive drinking occasions, the findings indicated that NA alcohol consumption was similar to or lower than that of whites—an empirical challenge to the elevated NA alcohol consumption belief.

4.2. NA and Asians, Hispanics, blacks and NHOPI

Statistically significant differences between Asians and NA were found in each of the demographics-adjusted regressions, except that for light/moderate drinking only. The significant differences were all in one direction: lower alcohol consumption among Asians compared to NA.

The findings for NA compared to Hispanics and blacks were relatively mixed. For example, the logistic regression for abstainers in NSDUH did not indicate a difference between NA compared to Hispanics and blacks, but the logistic regression for abstainers in BRFSS indicated greater abstinence among NA compared to Hispanics and blacks. The logistic regression for heavy drinkers (NSDUH) indicated lower odds of heavy drinking among Hispanics and blacks

Table 5
Association of number of excessive drinking occasions in past month with race/ethnicity and other demographics (BRFSS): Zero-inflated negative binomial regression.

	Negative binomial part		Zero-inflated part	
	IRR	(95% CI)	<i>b</i>	(95% CI)
Race/Ethnicity				
NA (ref)	1.00		1.00	
White	0.89	(0.75, 1.06)	−0.29**	(−0.48, −0.10)
Hispanic	0.58**	(0.49, 0.69)	−0.39***	(−0.60, −0.18)
Black	0.66***	(0.55, 0.79)	0.07	(−0.14, 0.28)
Asian	0.53***	(0.42, 0.65)	0.55***	(0.27, 0.83)
NHOPI	1.03	(0.69, 1.54)	0.25	(−0.16, 0.66)
Multiple races	1.06	(0.86, 1.30)	−0.05	(−0.29, 0.19)
Other ^a	0.84	(0.68, 1.03)	−0.07	(−0.32, 0.17)
Gender				
Male (ref)	1.00		1.00	
Female	0.54**	(0.52, 0.56)	0.94**	(0.89, 0.99)
Age				
65+ (ref)	1.00		1.00	
55–64	1.02	(0.94, 1.10)	−0.96***	(−1.02, −0.90)
45–54	0.93	(0.86, 1.01)	−1.70***	(−1.77, −1.63)
35–44	0.91*	(0.85, 0.99)	−2.17***	(−2.24, −2.09)
25–34	0.93	(0.86, 1.00)	−3.18***	(−3.30, −3.07)
18–24	1.01	(0.93, 1.09)	−3.22***	(−3.37, −3.06)
Education				
Some college ^b (ref)	1.00		1.00	
College graduate ^b	0.80**	(0.77, 0.83)	0.09***	(0.03, 0.14)
High school graduate	1.04	(0.99, 1.09)	0.05	(−0.01, 0.12)
<High school	1.13**	(1.05, 1.21)	0.16***	(0.06, 0.25)
Other ^a	1.05	(0.51, 2.14)	0.49	(−0.12, 1.11)
Household income				
\$75,000+ (ref)	1.00		1.00	
\$50,000–74,999	1.05	(0.99, 1.10)	0.21***	(0.15, 0.28)
\$20,000–49,999	1.12***	(1.07, 1.17)	0.38***	(0.32, 0.44)
< \$20,000	1.15***	(1.08, 1.22)	0.56***	(0.49, 0.64)
Other ^a	0.93	(0.86, 1.01)	0.78***	(0.70, 0.87)

Inalpha = 1.48; 95% CI (1.45, 1.51).

Excessive drinking (BRFSS) was defined as 5+ drinks for men and 4+ drinks for women on an occasion 1+ times in the past month. All of the independent variables were dummy coded. IRR = Incident Rate Ratio. CI = Confidence Interval. NA = Native American. NHOPI = Native Hawaiian/Other Pacific Islander.

^a Other/don't know/not sure/refused.^b Includes technical school.* $p \leq 0.05$.** $p \leq 0.01$.*** $p \leq 0.001$.

compared to NA. However, the logistic regression for binge drinkers (NSDUH) did not indicate a significant difference between NA compared to Hispanics and blacks. The logistic regression for excessive drinkers (BRFSS) indicated lower excessive drinking odds for blacks compared to NA, but a significant difference between Hispanics and NA was not indicated.

Statistically significant differences in alcohol consumption between NA and NHOPI were not indicated in any of the demographics-adjusted regressions. This absence of significant differences found, however, should be viewed in light of the fact that NHOPI had the smallest sample sizes in both the NSDUH and BRFSS analyses (cf. Satter et al., 2014; Tualii et al., 2014).

4.3. Healthcare implications

Alcohol misuse is a major health issue among whites, leading to the need for substantial treatment and prevention services (Center for Behavioral Health Statistics and Quality, 2014c). As estimates of NA heavy and binge drinker prevalence and number of excessive-drinking occasions were comparable to those of whites, NA too need substantial treatment and prevention services. Evidence challenging the elevated NA alcohol consumption belief does not take

away from this need. Whites, however, are able to avail themselves of alcohol-related services without the specter of a “drunken white” stereotype. Likewise, NA should be able to obtain such services without a “drunken Indian” stereotype (cf. Miheesuah, 1996).

Cultural differences are already known to sometimes limit the quality of interactions between NA and their healthcare providers (Gonzales et al., 2014; Johansson et al., 2006). Compound this with an embarrassing negative stereotype, and service quality could be further constrained (Betancourt and Ananeh-Firempong, 2004; Burgess et al., 2010; Gone and Trimble, 2012; Smedley et al., 2003).

4.4. NA Alcohol consumption and ALD mortality estimation

Provision of quality alcohol-related services for NA would also seem to be critically important given that, for example, ALD mortality among NA is reportedly 4.9 times that among whites (Landen et al., 2014). (Note: ALD is a general term referring to a spectrum of alcohol-related liver injuries, ranging from fatty liver to cirrhosis.) Given the present study's findings, however, the explanation for this mortality disparity does not seem to rest with extraordinary levels of alcohol misuse among NA, nor with a higher prevalence of drinkers in general, as this study found that NA compared to

whites were substantially more likely to abstain from alcohol (cf. [Office of Applied Studies, 2007](#)) and to not engage in light/moderate drinking. NA might have an elevated genetic risk for developing liver disease when consuming alcohol, but limited research on this possibility has been conducted ([Mendenhall et al., 1989](#); [Scott and Garland, 2008](#)). Research on alcohol dependence among NA and genetic variability has had mixed findings ([Cordova et al., 2013](#)), with some of the more recent studies (e.g., [Gizer et al., 2011](#); [Liu et al., 2011](#)) not detecting much association (cf. [Enoch, 2013](#)).

One might wonder whether alcohol misuse rates among NA were substantially higher than those among whites prior to the study period examined (2009–2013), and current NA-white disparities in ALD mortality rates reflect such a difference. This is an open question, but recall that [Chen et al. \(2006\)](#) found descriptive “heavier drinker” rates that seemed comparable among NA and whites in 2001–2002.

NA have been challenged by historical trauma and other stressors such as environmental pollution, poor nutrition, relatively high unemployment, educational challenges, and limited access to health care, all of which can be associated with increased disease rates ([Castor et al., 2006](#); [Chartier and Caetano, 2010](#); [Department of Health Statistics, 2009](#); [Rempel and Uhanova, 2012](#); [United States Census Bureau, 2011](#)), including possibly ALD.

NA reportedly have higher rates of obesity than do whites ([Cobb et al., 2014](#); [Schiller et al., 2012](#)), and obesity can potentiate ALD ([Diehl, 2004](#)). Also, obesity and the obesity-related metabolic conditions of hyperglycemia, hyperinsulinemia, hypertriglyceridemia and systolic hypertension have all been associated with increased risk of non-alcoholic fatty liver disease ([Bedogni et al., 2005](#)); a consideration here as reliably distinguishing non-alcoholic liver disease from ALD is problematic, and no current single laboratory or imaging test exists to confirm ALD ([European Association, 2012](#); [Torruellas et al., 2014](#)). Possible diagnostic ambiguity regarding ALD and non-alcoholic liver disease might place a group with higher rates of obesity at greater risk for inflated reports of ALD, especially if the group has also been stereotyped as elevated alcohol consumers (note: physicians use their subjective knowledge of patients' alcohol consumption patterns to help arrive at ALD versus non-alcoholic liver disease diagnoses; [Mueller et al., 2014](#)).

Finally, when attempting to understand a population's ALD rate, it is important to be mindful that most heavy alcohol consumers reportedly do not develop cirrhosis of the liver ([Lelbach, 1975](#); [Teli et al., 1995](#)), and that ALD's relationship to alcohol consumption is still in the early stages of study ([Altamirano and Bataller, 2011](#)).

4.5. Methodological considerations

Because NSDUH and BRFSS data are self-reported, their accuracy depends on respondents' truthfulness and memory, and under- and overreporting may consequently have taken place ([Center for Behavioral Health Statistics and Quality, 2014a](#); [Gfroerer et al., 1997](#)). Some NSDUH and BRFSS procedures differ (e.g., they use ACASI and CATI systems, respectively). In an analysis of the two systems' data from 1999 and 2001, [Miller et al. \(2004\)](#) reported that BRFSS produced lower estimates of elevated drinking than did NSDUH, suggesting lower disclosure regarding alcohol use for BRFSS. Consistent with this, for the typical drinking occasion in the present study, higher percentages of both NA and whites reported 1 drink in BRFSS compared to NSDUH (relative overrepresentation of lower drink counts also suggests less disclosure).

NSDUH's imputed race/ethnicity variable (used in the present study) may possibly have misclassified some individuals regarding Native American status. The BRFSS analysis did not use an imputed race/ethnicity variable. Such distinctions noted, the NSDUH and BRFSS analyses both indicated less consumption among NA compared to whites at the lower end of the drinking spectrum, and

they were consistent in not indicating elevated drinking among NA compared to whites.

Given that research has reported higher binge drinking rates among NA compared to the US general population ([Office of Applied Studies, 2010](#)), and whites are the largest and predominant racial/ethnic group in the United States ([Phinney, 1996](#); [Population Division, 2013](#)), one might have expected that binge drinking rates also would be higher among NA compared to whites. This expectation, however, was not supported by the present study's findings, raising a question as to the purpose of alcohol use comparisons between NA (a US racial/ethnic group) and the US general population (a group defined by US geography). If the goal is to facilitate understanding of the role of race/ethnicity in health-related behavior, an NA versus US general population comparison may be of limited usefulness, arguably an “apples and oranges” comparison. If the goal is to assess NA regarding a norm for alcohol use, an explanation would be helpful as to why a group identified by geography provides such a norm (cf. [Pettigrew, 1978](#)).

Alcohol consumption measurement has multiple approaches and is an ongoing topic of discussion (e.g., [Kamper-Jørgensen et al., 2004](#)). Future research may wish to compare NA and white alcohol consumption by considering measures beyond those analyzed here.

Findings for the full population of a racial/ethnic group do not necessarily generalize to a subpopulation of that group. For example, health-related findings for NA as a full population do not necessarily generalize to NA in a selected region or state of the United States or to NA in a selected age or income group. Consistent with this, alcohol use rates for the full population of a racial/ethnic group will often differ from (be higher/lower than) the rates for a selected subpopulation of that group.

5. Conclusions

In contrast to the ‘Native American elevated alcohol consumption’ belief, Native Americans compared to whites had lower or comparable rates across the range of alcohol measures examined. These findings can be used to help address misinformation about NA alcohol consumption. And they raise questions as to the origin of dramatically higher rates of alcoholic liver disease mortality reported for Native Americans.

Conflicts of interest

None.

Role of funding source

Nothing declared.

Contributors

JKC and TAS conceived the study. JKC conducted the analysis and wrote the initial draft. MLM contributed to the Discussion section. All of the authors edited the final version of the report.

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Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at <http://dx.doi.org/10.1016/j.drugalcdep.2015.12.015>.

References

- Albert, J.M., Wang, W., Nelson, S., 2014. Estimating overall exposure effects for zero-inflated regression models with application to dental caries. *Stat. Methods Med. Res.* 23, 257–278.
- Altamirano, J., Batailler, R., 2011. Alcoholic liver disease: pathogenesis and new targets for therapy. *Nat. Rev. Gastroenterol. Hepatol.* 8, 491–501.
- American Psychiatric Association, 2014. APA Fact Sheet: Mental Health Disparities: American Indians and Alaska Natives. Available at: <http://www.psychiatry.org/File%20Library/Practice/Diversity/Diversity%20Resources/Fact-Sheet-Native-Americans.pdf> (accessed 30.03.15).
- Beals, J., Spicer, P., Mitchell, C.M., Novins, D.K., Manson, S.M., Big Crow, C.K., Buchwald, D., Chambers, B., Christensen, M.L., Dillard, D.A., DuBray, K., Espinoza, P.A., Fleming, C.M., Frederick, A.W., Gurley, D., Jervis, L.L., Jim, S.M., Kaufman, C.E., Keane, E.M., Klein, S.A., Lee, D., McNulty, M.C., Middlebrook, D.L., Moore, L.A., Nez, T.D., Norton, I.M., Orton, H.D., Randall, C.J., Sam, A., Shore, J.H., Simpson, S.G., Yazzie, L.L., 2003. Racial disparities in alcohol use: comparison of 2 American Indian reservation populations with national data. *Am. J. Public Health* 93, 1683–1685.
- Beauvais, F., 1998. American Indians and alcohol. *Alcohol Health Res. World* 22, 253–259.
- Bedogni, G., Miglioli, L., Masutti, F., Tiribelli, C., Marchesini, G., Bellentani, S., 2005. Prevalence of and risk factors for nonalcoholic fatty liver disease: the Dionysos Nutrition and Liver Study. *Hepatology* 42, 44–52.
- Behavioral Risk Factor Surveillance System, 2014. 2013 Codebook Report Land-Line and Cell-Phone Data. Centers for Disease Control and Prevention, Atlanta, GA.
- Betancourt, J.R., Ananeh-Firempong II, O., 2004. Not me! Doctors, decisions, and disparities in health care. *Cardiovasc. Rev. Rep.* 25, 105–109.
- Burgess, D.J., Warren, J., Phelan, S., Dovidio, J., van Ryn, M., 2010. Stereotype threat and health disparities: what medical educators and future physicians need to know. *J. Gen. Intern. Med.* 25, S169–S177.
- Castor, M.L., Smyser, M.S., Tauaii, M.M., Park, A.N., Lawson, S.A., Forquera, R.A., 2006. A nationwide population-based study identifying health disparities between American Indians/Alaska Natives and the general populations living in select urban counties. *Am. J. Public Health* 96, 1478–1484.
- Center for Behavioral Health Statistics and Quality, 2014a. Results from the 2013 National Survey on Drug Use and Health: Summary of National Findings. Substance Abuse and Mental Health Services Administration, Rockville, MD.
- Center for Behavioral Health Statistics and Quality, 2014b. 2013 National Survey on Drug Use and Health Public Use File Codebook. Substance Abuse and Mental Health Services Administration, Rockville, MD.
- Center for Behavioral Health Statistics and Quality, 2014c. Treatment Episode Data Set (TEDS): 2002–2012. National Admissions to Substance Abuse Treatment Services. Substance Abuse and Mental Health Services Administration, Rockville, MD.
- Centers for Disease Control and Prevention, 2014. Behavioral Risk Factor Surveillance System. Overview: BRFSS 2013. Available at: http://www.cdc.gov/brfss/annual_data/2013/pdf/Overview_2013.pdf (accessed 06.09.15).
- Chartier, K., Caetano, R., 2010. Ethnicity and health disparities in alcohol research. *Alcohol Res. Health* 33, 152–160.
- Chen, C.M., Yi, H.-Y., Falk, D.E., Stinson, F.S., Dawson, D.A., Grant, B.F., 2006. Alcohol Use and Alcohol Use Disorders in the United States: Main Findings from the 2001–2002 National Epidemiologic Survey on Alcohol and Related Conditions (NESARC). National Institute on Alcohol Abuse and Alcoholism, Bethesda, MD.
- Cobb, N., Espey, D., King, J., 2014. Health behaviors and risk factors among American Indians and Alaska Natives, 2000–2010. *Am. J. Public Health* 104, S481–S489.
- Cohen, J., Cohen, P., West, S.G., Aiken, L.S., 2003. *Applied Multiple Regression/Correlation Analysis for the Behavioral Sciences*, third ed. Lawrence Erlbaum Associates, Inc., Mahwah, New Jersey.
- Cordova, F.M., Trujillo, M.H., Walker, R.D., 2013. American Indians/Alaskan Natives and alcohol: biology, nutrition, and positive programs. In: Watson, R.R., Preedy, V.R., Zibadi, S. (Eds.), *Alcohol, Nutrition, and Health Consequences*. Humana Press, New York, pp. 135–142.
- Department of Health Statistics and Informatics in the Information Evidence and Research Cluster of the World Health Organization, 2009. *Global Health Risks: Mortality and Burden of Disease Attributable to Selected Major Risks*. World Health Organization Geneva.
- Diehl, A.M., 2004. Obesity and alcoholic liver disease. *Alcohol* 34, 81–87.
- Enoch, M.-A., 2013. Genetic influences on the development of alcoholism. *Curr. Psychiatry Rep.* 15, <http://dx.doi.org/10.1007/s11920-013-0412-1>.
- Esser, M.B., Hedden, S.L., Kanny, D., Brewer, R.D., Gfroerer, J.C., Naimi, T.S., 2014. Prevalence of alcohol dependence among US adult drinkers, 2009–2011. *Prev. Chronic Dis.*, <http://dx.doi.org/10.5888/pcd11.140329>.
- European Association for the Study of the Liver, 2012. *EASL Clinical practical guidelines: management of alcoholic liver disease*. *J. Hepatol.* 57, 399–420.
- Gfroerer, J., Lessler, J., Parsley, T., 1997. Studies of nonresponse and measurement error in the national household survey on drug abuse. In: Harrison, L., Hughes, A. (Eds.), *The Validity of Self-Reported Drug Use: Improving the Accuracy of Survey Estimates*. NIDA Research Monograph 167. National Institutes of Health, Bethesda, MD, pp. 273–295.
- Gizer, I.R., Edenberg, H.J., Gilder, D.A., Wilhelmsen, K.C., Ehlers, C.L., 2011. Association of alcohol dehydrogenase genes with alcohol-related phenotypes in a Native American community sample. *Alcohol Clin. Exp. Res.* 35, 2008–2018.
- Gone, J.P., Trimble, J.E., 2012. American Indian and Alaska Native mental health: diverse perspectives on enduring disparities. *Annu. Rev. Clin. Psychol.* 8, 131–160.
- Gonzales, K.L., Lambert, W.E., Fu, R., Jacob, M., Harding, A.K., 2014. Perceived racial discrimination in health care, completion of standard diabetes services, and diabetes control among a sample of American Indian women. *Diabetes Educ.* 40, 747–755.
- Hilbe, J.M., 2007. *Negative Binomial Regression*. Cambridge University Press, New York.
- Indian Health Service, 2015. Behavioral Health Fact Sheet. Available at: <http://www.ihs.gov/newsroom/factsheets/behavioralhealth/> (accessed 22.04.15).
- Johansson, P., Jacobsen, C., Buchwald, D., 2006. Perceived discrimination in health care among American Indians/Alaska Natives. *Ethn. Dis.* 16, 766–771.
- Kamper-Jørgensen, M., Grønbaek, M., Tolstrup, J., Becker, U., 2004. Alcohol and cirrhosis: dose-response or threshold effect? *J. Hepatol.* 41, 25–30.
- Kanny, D., Liu, Y., Brewer, R.D., Lu, H., 2013. Binge drinking—United States, 2011. *MMWR* 62 (Suppl. 3), 77–80.
- Landen, M., Roeber, J., Naimi, T., Nielsen, L., Sewell, M., 2014. Alcohol-attributable mortality among American Indians and Alaska Natives in the United States, 1999–2009. *Am. J. Public Health* 104, S343–S349.
- Leland, J., 1976. *Firewater Myths*. North American Indian Drinking and Alcohol Addiction. Rutgers Center of Alcohol Studies, New Brunswick, NJ.
- Leibach, W.K., 1975. Cirrhosis in the alcoholic and its relation to the volume of alcohol abuse. *Ann. N. Y. Acad. Sci.* 252, 85–105.
- Liu, J., Zhou, Z., Hodgkinson, C.A., Yuan, Q., Shen, P.-H., Mulligan, C.J., Wang, A., Gray, R.R., Roy, A., Virkkunen, M., Goldman, D., Enoch, M.-A., 2011. Haplotype-based study of the association of alcohol-metabolizing genes with alcohol dependence in four independent populations. *Alcohol Clin. Exp. Res.* 35, 304–316.
- May, P.A., Gossage, J.P., 2001. New data on the epidemiology of adult drinking and substance use among American Indians of the northern states: male and female data on prevalence, patterns, and consequences. *Am. Indian Alsk. Native Ment. Health Res.* 10, 1–26.
- Mendenhall, C.L., Gartside, P.S., Roselle, G.A., Grossman, C.J., Weesner, R.E., Chedid, A., the V.A Cooperative Study Group, 1989. Longevity among ethnic groups in alcoholic liver disease. *Alcohol Alcohol* 24, 11–19.
- Mihesuah, D.A., 1996. *American Indians: Stereotypes and Realities*. Clarity Press Inc., Atlanta, GA.
- Miller, J.W., Gfroerer, J.C., Brewer, R.D., Naimi, T.S., Mokdad, A., Giles, W.H., 2004. Prevalence of adult binge drinking: a comparison of two national surveys. *Am. J. Prev. Med.* 27, 197–204.
- Miller, K.A., Stanley, L.R., Beauvais, F., 2012. Regional differences in drug use rates among American Indian youth. *Drug Alcohol Depend.* 126, 35–41.
- Moore, A.A., Gould, R., Reuben, D.B., Greendale, G.A., Carter, K., Zhou, K., Karlamangla, A., 2005. Longitudinal patterns and predictors of alcohol consumption in the United States. *Am. J. Public Health* 95, 458–464.
- Mueller, S., Seitz, H.K., Rausch, V., 2014. Non-invasive diagnosis of alcoholic liver disease. *World J. Gastroenterol.* 20, 14626–14641.
- Mullany, B., Barlow, A., Neault, N., Billy, T., Hastings, R., Coho-Mescal, V., Lorenzo, S., Walkup, J.T., 2013. Consistency in the reporting of sensitive behaviors by adolescent American Indian women: a comparison of interviewing methods. *Am. Indian Alsk. Native Ment. Health Res.* 20, 42–51.
- Office of Applied Studies, 2007. The NSDUH Report: Substance Use and Substance Use Disorders Among American Indians and Alaska Natives. Substance Abuse and Mental Health Services Administration, Rockville, MD.
- Office of Applied Studies, 2010. The NSDUH Report: Substance Use Among American Indian or Alaska Native Adults. Substance Abuse and Mental Health Services Administration, Rockville, MD.
- Pettigrew, T.F., 1978. Three issues in ethnicity: boundaries, deprivations, and perceptions. In: Yinger, J.M., Cutler, S.J. (Eds.), *Major Social Issues: A Multidisciplinary View*. The Free Press, New York, pp. 25–49.
- Phinney, J.S., 1996. When we talk about American ethnic groups, what do we mean? *Am. Psychol.* 51, 918–927.
- Population Division, 2013. *Annual Estimates of the Resident Population by Sex, Age, Race Alone or in Combination, and Hispanic Origin for the United States and States: April 1, 2010 to July 1, 2012*. US Census Bureau, Washington, DC.
- Preisser, J.S., Stamm, J.W., Long, D.L., Kincade, M.E., 2012. Review and recommendations for zero-inflated count regression modeling of dental caries indices in epidemiological studies. *Caries Res.* 46, 413–423.
- Rempel, J.D., Uhanova, J., 2012. Hepatitis C virus in American Indian/Alaskan Native and Aboriginal peoples of North America. *Viruses* 4, 3912–3931.
- Satter, D.E., Randall, L.L., Solomon, T.G.A., 2014. The complexity of American Indian and Alaska Native health and health research: historical, social, and political implications for research. In: Solomon, T.G.A., Randall, L.L. (Eds.), *Conducting Health Research with Native American Communities*. APHA Press, Washington, DC, pp. 1–22.
- Schiller, J.S., Lucas, J.W., Peregoy, J.A., 2012. *Summary Health Statistics for U.S. Adults: National Health Interview Survey, 2011*. Vital and Health Statistics Series 10, Number 256. National Center for Health Statistics, Washington, DC.

- Schoolcraft, H.R., 1847. *Inquiries Respecting the History, Present Condition and Future Prospects of the Indian Tribes of the United States*. US Government Printing Office, Washington, DC.
- Scott, J.D., Garland, N., 2008. Chronic liver disease in Aboriginal North Americans. *World J. Gastroenterol.* 14, 4607–4615.
- Smedley, B.D., Stith, A.Y., Nelson, A.R. (Eds.), 2003. *Unequal Treatment: Confronting Racial and Ethnic Disparities in Health Care*. The National Academies Press, Washington, DC.
- Stanley, L.R., Harness, S.D., Swaim, R.C., Beauvais, F., 2014. Rates of substance use of American Indian students in 8th, 10th, and 12th grades living on or near reservations: update, 2009–2012. *Public Health Rep.* 129, 156–163.
- StataCorp, 2015. Stata: Release 14. Statistical Software. StataCorp LP, College Station, TX.
- Teli, M.R., Day, C.P., Burt, A.D., Bennett, M.K., James, O.F.W., 1995. Determinants of progression to cirrhosis or fibrosis in pure alcoholic fatty liver. *Lancet* 346, 987–990.
- Torruellas, C., French, S.W., Medici, V., 2014. Diagnosis of alcoholic liver disease. *World J. Gastroenterol.* 20, 11684–11699.
- Tauaii, M., Quenga, J., Samoa, R., 2014. Understanding diversity among indigenous people: conducting research with Native Hawaiians and Pacific Islanders. In: Solomon, T.G.A., Randall, L.L. (Eds.), *Conducting Health Research with Native American Communities*. APHA Press, Washington, DC, pp. 109–127.
- United States Census Bureau, 2011. Profile America Facts for Features. American Indian and Alaska Native Heritage Month. US Census Bureau, Washington, DC.
- United States Census Bureau, 2012a. Statistical Abstract of the United States 2012: Table 697. Available at: <https://www.census.gov/compendia/statab/2012/tables/12s0697.pdf> (accessed 18.03.15).
- United States Census Bureau, 2012b. Statistical Abstract of the United States 2012: Table 229. Available at: <https://www.census.gov/compendia/statab/2012/tables/12s0229.pdf> (accessed 18.03.15).
- Young, R.S., Joe, J.R., 2009. Some thoughts about the epidemiology of alcohol and drug use among American Indian/Alaska Native populations. *J. Ethn. Subst. Abuse* 8, 223–241.