Alcohol and Marijuana, Risk Factors for Binge Drinking and Interaction Effect of Race

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Abstract. Past research has suggested the relationship between alcohol and marijuana use. However, how perceptions of marijuana risk and availability are associated with alcohol misuse and the effect of race on its relation remain unclear. This study used data from the 2022 National Survey on Drug Use and Health (NSDUH) to analyze the significance and direction of the interaction effect of race on the relation between binge drinking and marijuana use, risk perception and perceived availability among 57,169 U.S. respondents aged 12+ years. Results from weighted logistic regression and interaction modeling suggested that risk perception of binge drinking had greater effects on binge drinking behaviors among Whites compared to Blacks ($p < 0.05$), and similarly, perceived marijuana availability affected binge drinking behaviors to a larger extent among Whites than among Blacks ($p < 0.01$). Perceived risk of marijuana and use of marijuana weren't found to have interaction effects with race on binge drinking. To conclude, binge drinking was associated with not only the perceived risk of alcohol but also with marijuana regarding its use, risk perception, and availability. The presence of the interaction effect of race highlights the importance when studying a wide range of populations, of subgroup analyses to capture substance use patterns more accurately and to design and implement more efficient prevention and intervention services.

Keywords: Substance Use, Binge Drinking, Race, Logistic Regression, Risk Factors.

1. Introduction

Alcohol-induced mortality has been increasing over the past few years. According to WHO, alcohol consumption could cause not only noncommunicable diseases such as poor mental health conditions, liver cirrhosis, and heart disease, but also harm to others, for instance, car accidents, sexual assault, and violence. A recent study showed that mortality caused by alcohol consumption, whether direct or indirect, increased by 14.1% per year from 2018 to 2020 in the USA, with the increase rate being 14.3% per year among non-Hispanic Whites, and Asian Americans had an increase rate of 9.5% per year from 2015 to 2020 [1].

Race and other demographic variables should be considered as baseline factors when studying health-related issues and risk factors [2]. Stress is one of the risk factors for alcohol consumption and misuse. For example, it has been suggested that compared to Whites, at-risk alcohol use happened more frequently among African Americans who were more likely to cope with stress through unhealthy eating and substance use, including alcohol [2]. Other studies have shown that during COVID-19, people of color suffered more pandemic-related stress, including COVID-19 victimization stress, societal bias, and employment and housing disruption, all of which could lead to increased alcohol use as a coping strategy [3]. One study suggested that Asian Americans experienced more online racism compared to Whites, which could lead to an increase in substance and alcohol use [4]. In addition to stress, risk perception is also associated with substance use. One study showed that adolescents who perceived high risks from using substances reported less past-month use than those who did not perceive high risks [5]. Moreover, it has been shown that cannabis risk perception and its availability had a joint effect on many cannabis-related outcomes [6]. Alcohol and other substances are found to be consumed both separately and concurrently. According to past studies, binge drinkers had four times the odds of using other substances than non-binge drinkers [7].

However, few studies analyzed the association between alcohol misuse and the perception of risk and availability of other substances, such as marijuana, or, if any, the interaction effect of race. When

a baseline factor, such as demographics, influences the effect of another variable on the outcome, the interaction effect is present [8]. The current study explored the association between marijuana use, perception of risk and availability, and binge drinking and whether it could be affected by race using data from the National Survey on Drug Use and Health.

2. Methods

2.1. Data Source

The data came from the 2022 public use files (PUF) of the National Survey on Drug Use and Health (NSDUH), conducted by the Substance Abuse and Mental Health Services Administration (SAMHSA) yearly. NSDUH provides data on participants' demographics, mental health conditions, alcohol and drug misuse, and perception of risk and availability among the civilian, noninstitutionalized population aged 12+ years in the U.S. Starting in 2020, interviews could take place either in-person or online. There were 59,069 records in the 2022 PUF; approximately 42% were completed via the web. Additional details regarding sample design and methodology can be found in the 2022 NSDUH Public Use File Codebook.

2.2. Measures

The 2022 PUF had 2,605 variables, including original questions, imputed variables to correct missing or invalid responses and recoded variables. The current analyses included gender, age group, race, perceived risk of binge drinking, perceived risk of marijuana, use of marijuana, perception of marijuana availability as explanatory variables, and past-month binge drinking as the response variable.

2.2.1. Demographics

Gender was recorded as male or female. The age group was recorded from participants' reported ages into five levels: 12-17, 18-25, 26-34, 35-49, and 50+ years old. NSDUH recoded race into seven groups: Non-Hispanic White, Black/African American, Native American/Alaska Native, Native Hawaiian/Other Pacific Islander, Asian, multirace, and Hispanic. Demographic variables were imputed to correct missing or invalid values.

2.2.2. Marijuana

The 2022 survey asked for participants' marijuana use, perceived risk, and whether relatively easy to obtain. Interviewees were first asked about the time since the last use of marijuana. Answers were categorized into two groups: "Used within the past month" and "Did not use in the past month", the latter also included the response "Never used marijuana". Similarly, the question regarding the perception of marijuana risk asked participants how much people risk harming themselves when smoking marijuana once a month. The recoded variable had two levels: "Great Risk" and "Otherwise" which included answers "No risk", "Slight risk", and "Moderate risk". Perception of marijuana availability was measured by asking whether it is easy or not to get marijuana, and final categories included "Fairly or Very Easy" and "Otherwise".

2.2.3. Binge drinking

Binge drinking is, by definition, a male consuming five or more or a female four or more drinks on the same occasion at least once in the past 30 days. Participants were asked about the risk of binge drinking, and responses were categorized into two groups: "Great Risk" and "Otherwise" which included "No risk", "Slight risk", and "Moderate risk". The imputed variable of the past-month binge drinking frequency had two levels: "Binge alcohol use" and "Never/No binge alcohol use".

2.3. Statistical Analysis

The sample had a large portion of non-Hispanic Whites compared to other race groups. For analysis purposes, non-Hispanic Native American/Alaska Native, Native Hawaiian/Other Pacific Islander, and multirace were combined into Non-Hispanic Other to increase the group size.

2.3.1. Logistic regression

Weighted logistic regression was applied to quantify the relationship between past-month binge drinking and 1). perceived risk of binge drinking, 2). perceived risk of marijuana, 3). use of marijuana, 4). perception of marijuana availability, adjusting for gender, age group, and race.

2.3.2. Interaction effect of race

The interaction effect of race was assessed individually for each explanatory variable by interaction modeling, adding an interaction term to the logistic regression model (race * variable), and adjusting for gender and age groups. All analyses were conducted in R, and weighted estimates were produced using the survey package [9]. Clustering, strata, and sampling weights complied with the 2022 NSDUH PUF Codebook instructions.

3. Results

Descriptive statistics are presented in Table 1. There were 57,169 out of 59,069 records with valid values in any of the abovementioned eight variables, and 12,598 reported binges drinking during the last 30 days (54% male). Logistic regression showed that all four explanatory variables were associated with past-month binge drinking (Table 2). For example, the odd ratio of past-month binge drinking between those who perceived low risks from binge drinking and those who perceived high risks was approximately 2.5:1 (AOR = 2.53, $p < 0.001$). In addition, perceiving low risks from marijuana, using marijuana, and believing marijuana was easy to obtain were all associated with increased odds of past-month binge drinking.

Table 1. Descriptive statistics

Binge Drinking	No (n = 44,571)	Yes (n = 12,598)
Sex		
Male	20,206 (48%)1	5,976 (54%)
Female	24,365 (52%)	6,622 (46%)
Race		
Non-Hispanic White	25,422 (60%)	7,850 (63%)
Non-Hispanic Black	5,516 (12%)	1,328 (12%)
Non-Hispanic Other	2,741 (3%)	751 (3%)
Non-Hispanic Asian	2,561 (6.8%)	358 (2.8%)
Hispanic	8,331 (18%)	2,311 (19%)
Age Group		
12-17	10,919 (11%)	429 (1.4%)
18-25	9,888 (11%)	4,083 (17%)
26-34	6,416 (12%)	2,977 (22%)
35-49	8,799 (20%)	3,466 (29%)
50+	8,549 (45%)	1,643 (32%)
1.N (weighted %)		

Table 2. Logistic regression on binge drinking and other variables

Variable	AOR	95% C.I.	p
perceived risk of binge drinking[1]	2.53	(2.35, 2.71)	< 0.001
perceived risk of marijuana[2]	2.15	(1.88, 2.46)	< 0.001
use of marijuana[3]	2.77	(2.48, 3.1)	< 0.001
perception of marijuana availability[4]	2.21	(1.97, 2.48)	< 0.001
Note: 1.ref: perceived risk of binge drinking = high 2.ref: perceived risk of marijuana = high 3.ref: use of marijuana = no 4.ref: perception of marijuana availability = low			

P-value was used to indicate the significance, directions could be determined from the estimated coefficient signs (Table 3). As suggested, the interaction effect of race was significant when comparing non-Hispanic Whites with non-Hispanic Blacks ($p < 0.05$) and the group of non-Hispanic Other ($p < 0.01$) regarding the association between the perceived risk of binge drinking and past-month binge drinking. Individual models on each race group showed that for non-Hispanic Whites, those who perceived binge drinking as a low risk had greater odds (AOR = 2.79, $p < 0.001$) of past-month binge drinking (Table 4). For non-Hispanic Blacks, the odd ratio of past-month binge drinking between those perceiving low risks and high risks was approximately 2:1 (AOR = 2.24, $p < 0.001$). Within the group of non-Hispanic Other, perceiving low risks from binge drinking was associated with increased odds of past-month binge drinking (AOR = 1.44), though caution is needed when deciding the significance of the association ($p = 0.055$). Non-Hispanic Whites had the largest estimated adjusted odd ratio, which was consistent with the negative sign of the interaction effect of race for non-Hispanic Blacks and the group of non-Hispanic Other.

Interaction modeling also suggested that race significantly influenced the effect, in the opposite direction, of the perception of marijuana availability on past-month binge drinking when comparing non-Hispanic Whites to non-Hispanic Blacks ($p < 0.01$) and Hispanic ($p < 0.01$). For non-Hispanic Whites, those who believed marijuana was relatively easy to obtain had greater odds (AOR = 2.60, $p < 0.001$) of past-month binge drinking (Table 5). Among non-Hispanic Blacks, the odd ratio of past-month binge drinking between those with easy access to marijuana and those without was approximately 1.6:1 (AOR = 1.65, $p < 0.001$), similar for Hispanic (AOR = 1.78, $p < 0.001$). The AOR was the largest among non-Hispanic Whites, consistent with the negative signs of the estimated

coefficients of the interaction terms. Effects of the perceived risk of marijuana and the use of marijuana on past-month binge drinking were not significantly influenced by race.

Table 3. Results from interaction modelling on the effect of race

Race[1]	perceived risk of binge drinking			perception of marijuana availability		
	coef	95% C.I.	p	coef	95% C.I.	p
Non-Hispanic Black	-0.24	(-0.46, -0.01)	0.042*	-0.46	(-0.8, -0.13)	0.008**
Non-Hispanic Other	-0.66	(-1.04, -0.27)	0.001**	0.35	(-0.23, 0.93)	0.228
Non-Hispanic Asian	-0.24	(-0.82, 0.34)	0.407	-0.21	(-0.79, 0.38)	0.481
Hispanic	-0.21	(-0.42, 0.01)	0.063	-0.37	(-0.64, -0.1)	0.008**
Note: *: $p < 0.05$ **: $p < 0.01$ 1.ref: Non-Hispanic White						

Table 4. Binge drinking and its risk perception

	AOR[1]	95% C.I.	p
Non-Hispanic White	2.79	(2.55, 3.04)	< 0.001
Non-Hispanic Black	2.24	(1.85, 2.73)	< 0.001
Non-Hispanic Other	1.44	(0.99, 2.08)	0.055
Note: 1.ref: perceived risk of binge drinking = high			

Table 5. Binge drinking and marijuana availability

	AOR[1]	95% C.I.	p
Non-Hispanic White	2.60	(2.23, 3.04)	< 0.001
Non-Hispanic Black	1.65	(1.27, 2.14)	< 0.001
Hispanic	1.78	(1.41, 2.24)	< 0.001
Note: 1.ref: perception of marijuana availability = low			

4. Discussion

The results of the current study demonstrated the interaction effect of race when studying the effect of risk factors for binge drinking. For instance, the analyses suggested that the perceived risk of binge drinking would affect one's actual drinking behaviors, but the influence was larger among non-Hispanic Whites when compared with non-Hispanic Blacks. This finding highlights the need for continuous education by agencies to the public on the risk of alcohol in reducing alcohol consumption and misuse, and program directors and policymakers should consider its effectiveness based on targeting audiences' racial backgrounds when designing and implementing a portfolio of intervention services.

The current study also suggested that the perception of marijuana availability was a risk factor for binge drinking, and how it affected drinking behaviors could be influenced by race. If comparing those who believed marijuana was easy to obtain with those who did not have easy access to marijuana, non-Hispanic Whites showed a more considerable between-group difference compared to Hispanics. In other words, the effectiveness of restricting marijuana availability to control alcohol misuse would be the highest among non-Hispanic Whites. Past studies have found that alcohol and marijuana could act as substitutes or complements, and how policy regarding one substance would affect the consumption of the other needs to be analyzed from various aspects. For example, one past study showed that cannabis recreational legalization would be followed by an increase in cannabis/alcohol co-use among adults aged 21+ years [10]. Future studies are needed to investigate the combination of baseline factors, including age group, gender, race, and their interaction effects

on the relation between marijuana and alcohol, and analyses on the direction and significance of these effects could help capture substance use patterns for each subgroup more accurately.

5. Conclusion

This study analyzed the relationship between the perception of alcohol and marijuana risk and availability and binge drinking. Logistic regression showed statistical significance with 1). low perceived risks from binge drinking, 2). low perceived risks from marijuana, 3). marijuana use, 4). easy access to marijuana all associated with increased binge drinking behaviors. The analyses on the interaction effect of race suggested that the effectiveness of educating on the risk of binge drinking and controlling marijuana availability in reducing alcohol misuse would be higher among non-Hispanic Whites compared to non-Hispanic Blacks and Hispanics. These results highlight the need for continuous and regular education on the risks of marijuana and alcohol in reducing problematic drinking behaviors, and the importance of subgroup analyses by considering interaction effects of baseline factors when studying substance use patterns from a wide range of populations.

References

[1] Maleki N, Yunusa I, Karaye I M. Alcohol-induced mortality in the USA: trends from 1999 to 2020. Int J Ment Health Addiction, 2023.

[2] Pérez-Stable E J, Rodriquez E J. Social determinants and differences in mortality by race/ethnicity. JAMA Netw Open. 2020, 3 (2): e1921392.

[3] Tao X, Liu T, Fisher C B, et al. Covid-related social determinants of substance use disorder among diverse U.S. racial ethnic groups. Social Science & Medicine, 2023, 317, 115599.

[4] Keum B T, Ángel Cano M. Online racism, depressive and anxiety symptoms, coping-related drinking motives, and alcohol use severity among black, latina/o/x, and Asian emerging adults. Addictive Behaviors, 2023, 136, 107468.

[5] Lipari R N. Trends in adolescent substance use and perception of risk from substance use. 2013 Jan 3. In: The CBHSQ Report. Rockville (MD): Substance Abuse and Mental Health Services Administration (US); 2013.

[6] Levy N S, Mauro P M, Mauro C M, et al. Joint perceptions of the risk and availability of Cannabis in the United States, 2002-2018. Drug Alcohol Depend. 2021, 226: 108873.

[7] Esser M B, Pickens C M, Guy G P, et al. Binge drinking, other substance use, and concurrent use in the u. s., 2016 – 2018. American Journal of Preventive Medicine, 2021, 60 (2), 169 - 178.

[8] Brankovic M, Kardys I, Steyerberg E W, et al. Understanding of interaction (subgroup) analysis in clinical trials. Eur J Clin Invest. 2019. 49: e13145.

[9] Sabina Subbaraman, D. M. Substitution and complementarity of alcohol and cannabis: A review of the literature. Substance use & Misuse, 2016, 51 (11), 1399.

[10] Gonçalves P D, Levy N S, Segura L E, et al. Cannabis recreational legalization and prevalence of simultaneous cannabis and alcohol use in the United States. J Gen Intern Med, 2023, 38, 1493 – 1500.