



Logistic Regression Model of Demographic Predictors and Confounders of Binge Alcohol Use Among Adults with Major Depression

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Abstract

Identifying sociodemographic populations with a major depressive episode (MDE) who are at increased risk for binge alcohol use (BAU) is critical for developing focused prevention programs to meet the needs of each population. Thus, the goal of the current exploratory retrospective study is to examine if sex, race, age, education, marital status, and income can significantly predict the risk for BAU among adults with MDE and if the association between MDE and BAU changes after adjusting for demographic variables in question while holding sex, race, and age as constant variables. Data from the Substance Abuse and Mental Health Services Administration's 2018 National Survey for Drug Use and Health were extracted and analyzed to achieve the study goal. The unweighted sample included 6,999 adults representing a weighted population size of 33,900,452.122 in the USA. Results revealed that age and marital status significantly predicted BAU in the past month among adults with MDE. Adults under the age of 50, with a college degree, never married, divorced/separated, and with a high-middle income level or higher were at higher risk for BAU. The study's clinical implications are that understanding demographics of individuals with MDE at increased risk for BAU can inform improved tailored assessment and treatment of alcohol abuse and MDE among at-risk populations. Future research should consider examining additional potential risk factors for BAU among adults with MDE.

Keywords Demographic predictors · Adjustment for confounders · Binge alcohol use · Major depressive episode · Complex survey design

Individuals who suffer from major depression often turn to alcohol for relief from symptoms of depression. However, alcohol creates a vicious cycle of repeated use that can quickly progress to addiction, harm the brain, and exacerbate depressive symptoms (Boschloo, 2012; Boschloo et al., 2013). A total of 24% of adults aged 18 or older report that they had engaged in binge drinking in the past month (Center for Behavioral Health Statistics & Quality, 2021). Binge drinking is most common among younger adults aged

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18–34 years, but more than half of the total binge drinks are consumed by 35 and older (Kanny et al., 2018). Binge drinking is twice as common among men as women (Center for Behavioral Health Statistics & Quality, 2021). Binge drinking is also more common among people with household incomes of \$75,000 or more and higher educational levels, although binge drinkers with lower incomes and educational levels consume more binge drinks per year (Center for Behavioral Health Statistics & Quality, 2021).

Studies confirmed the prevalence of excessive alcohol use among a broad range of demographic populations across sex, age, marital status, and income, and its influence on individuals' general health status, mortality, the burden of disease, and violent crime (Bravo et al., 2017; Bravo et al., 2018; Brodin Låftman et al., 2021; Charlet & Heinz, 2017; García-Esquinas et al., 2018; Benjamin H Han et al., 2019; Keyes et al., 2019; Lardier et al., 2020; McHugh & Weiss, 2019; Peacock et al., 2018; Trangenstein et al., 2018; Yoon et al., 2019). In general, psychiatric disorders, particularly depressive disorders, are among the most prevalent psychiatric conditions that co-occur with alcohol consumption among adults and co-occur more often than expected by chance (Castillo-Carniglia et al., 2019; Charlet & Heinz, 2017; McHugh & Weiss, 2019).

Many past studies confirmed the prevalence of excessive alcohol use among a broad range of demographic populations across sex, age, race, education, marital status, and income (Assari et al., 2019; García-Esquinas et al., 2018; Grapiglia et al., 2021; Keyes et al., 2019; Mulia et al., 2018; Omary & Chambers, 2021) (Assari et al., 2019; Bjørk et al., 2006; Caetano, 1987; Fleury et al., 2014; García-Esquinas et al., 2018; Han et al., 2017; Keyes et al., 2019). An estimated 95,000 Americans die from alcohol-related causes annually, making alcohol the third leading preventable cause of death in the USA (National Institute on Alcohol Abuse & Alcoholism, 2020).

Because this is a relatively common health status concern among the general population, there is urgent to identify individuals at greater risk, such as adults with major depression. Adults diagnosed with major depressive episodes (MDE) at risk for BAU may directly impact their longevity, quality of life, individual safety, work productivity, and preventive treatment planning. Although health determinants can act as a buffer against the increased risk for risky health behaviors among adults with MDE (Catalano et al., 2011; Mirowsky & Ross, 2001; Omary, 2020; Rendall et al., 2011), evidence is lacking on binge alcohol drinking risk among adults with MDE while adjusting for demographic confounders. Identifying sociodemographic populations with MDE who are at increased risk for BAU would allow for the development of focused prevention programs to meet the needs of each population. To address the gap in evidence, the present exploratory retrospective study had two objectives: (1) to explore if the six predictors of sex, race, age, education, marital status, and income can significantly predict the risk for BAU among adults with MDE; and (2) to examine whether the association between MDE and BAU changes after adjusting for demographic variables in question (i.e., education, marital status, and income), while holding sex, race, and age as constant variables.

Method

Data Source

The present study utilized public-use data and documentation from the 2018 National Survey for Drug Use and Health (NSDUH) survey obtained from the Substance Abuse

and Mental Health Services Administration's (SAMHSA) (<http://www.datafiles.samhsa.gov>). The public-use data contain 56,313 records of non-institutionalized individuals representing a weighted population size of 273,753,042.56. Study participants met the following criteria: (a) were 18 years old or older and (b) had a lifetime MDE diagnosis. Participants were considered to have a lifetime MDE diagnosis if they were depressed for at least 2 weeks within the last 12 months, lost interest or pleasure in daily activities, had problems with sleeping, eating, energy, and concentration, or had low self-esteem. The MDE questions were based on diagnostic criteria from the *Diagnostic and Statistical Manual of Mental Disorders* (fifth edition) (Substance Abuse and Mental Health Services Administration, 2019b). The unweighted sample included 6,999 adults representing a weighted population size of 33,900,452.122 in the USA.

Measures

The NSDUH public health data files were extracted and analyzed. The NSDUH is the primary, nationally representative source of annual estimates on illicit drugs, alcohol, tobacco, and mental health issues among the US non-institutionalized population (including civilians living on military bases), 12 years and older (Center for Behavioral Health Statistics & Quality, 2019c), and from national, regional, state, and sub-state areas.

The survey enables users to produce estimates of demographic characteristics, drug, and alcohol use, and mental health problems from national, regional, state, and sub-state areas (<http://www.datafiles.samhsa.gov>). As NSDUH is publicly available and contains no identifying information regarding respondents, there was no risk of disclosure or violation of individual privacy; thus, informed consent was not obtained. The appropriate institutional review board approved all study procedures.

Data Coding

All NSDUH records of adults 18 years old and older with MDE were included in the study. Records with MDE were coded as "1," and all others were coded as "0." Only those who were coded with "1" were included in the analyses. The main independent variables were sex, race, age, education, marital status, and income. The race variable had seven categories (i.e., Hispanic, Multiple races, Asian, Native Pacific, Native Indian, Black/African American, and White). Age was categorized into four groups (i.e., 18–25, 26–34, 35–49, and 50 or older), education level included five groups (i.e., less than high school, high school graduate, some college/associate degree, college graduate, 12–17 years old), marital status included four categories (i.e., married, widowed, divorced or separated, and never married), and income included four levels (less than \$20,000, 20,000–49,999, 50,000–74,999, and 75,000 or more) (Center for Behavioral Health Statistics and Quality, 2019d). Because only 18 years and older participants were included in this study, category five in education level (i.e., those aged 12–17 years) was coded "0" and excluded from further analysis.

The outcome measure was BAU in the past month, defined as drinking five or more drinks for males or four or more drinks for females on the same occasion (i.e., at the same time or within a couple of hours of each other, on at least 1 day in the past 30 days) (Center for Behavioral Health Statistics & Quality, 2019c). The outcome measure was obtained

from the “substance use” section designed to provide data on the use of various substances in the NSDUH and included two categories, never/no binge alcohol use and binge alcohol use in the past 30 days.

Confounders included three demographic correlates treated once as a factor and once as a potential confounder for binge alcohol use among adults with MDE: education, marital status, and income.

Missing Data

Missing data in the public-use NSDUH database were given different codes according to their type (Center for Behavioral Health Statistics and Quality, 2019d). Imputation-revised variables and selected recoded versions of these variables were included for selected demographic, drug use, and substance use disorder variables. Missing values for all imputation-revised variables were imputed using the statistical imputation procedures described in the Statistical Imputation section of the NSDUH survey documentation (Center for Behavioral Health Statistics & Quality, 2019c; Substance Abuse and Mental Health Services Administration, 2019a). Imputation indicators were provided for each variable to determine whether an observation contained data from the survey or an imputed value (Center for Behavioral Health Statistics & Quality, 2019c).

Analyses

As the NSDUH is a national survey that uses multistage and deeply stratified sampling, data were weighted to obtain unbiased estimates for survey outcomes to represent civilian members of the non-institutionalized population in the USA. Design variables variance estimation (pseudo) replicate within stratum (VEREP), variance estimation (pseudo) stratum (VESTR). The person-level analysis weights (ANALWT_C) are applied to the statistical analyses to account for the sampling method used in data collection, ensure accurate point estimation regarding the standard errors, and allow the results of the analyses to be generalized to the entire US population (Center for Behavioral Health Statistics & Quality, 2019c). The ANALWT_C is the product of 16 weight components from the analytic file, and two additional weight calibration adjustments were made for the public use file (Center for Behavioral Health Statistics & Quality, 2019a). Each weight component accounts for either a selection probability at a selection stage or an adjustment factor adjusting of nonresponse, coverage, or extreme weights. VEREP and VESTR are nesting variables used to capture explicit stratification and identify clustering with the NSDUH data. These are needed to compute the variance estimates correctly (Center for Behavioral Health Statistics & Quality, 2019a) and ensure accurate point estimation regarding standard errors, allowing generalizability of the results to the entire US population (Center for Behavioral Health Statistics & Quality, 2019b).

A weighted binary logistic regression analysis was performed to first examine whether sex, race, age, education, marital status, and income significantly predict past month BAU among adults with MDE, and second to assess if lifetime MDE can still predict BAU risk among adults after adjusting for education, marital status, and income, while holding sex, race, and age as constant variables.

Secondary data analysis was used to analyze the NSDUH records of interest. Due to the complex sample design of the NSDUH, estimates were calculated using a method in SPSS 26 that is unbiased for linear statistics. This method uses multistage clustered sample designs where the first stage (primary) sampling units are drawn with replacement. The

data is weighted to obtain unbiased estimates for survey outcomes to represent civilian members of the non-institutionalized population in the USA (Center for Behavioral Health Statistics & Quality, 2019c).

Because past BAU was a binary dependent variable, the binary logistic model analysis was appropriate for estimating their presence or absence probabilities. To examine potential demographic predictors of the risk for past month BAU among adults with MDE while adjusting for the other demographic variables as potential confounding factors, weighted binary logistic regression analyses were performed with education, marital status, and income treated once as independent variables and once as confounding variables while holding sex, race, and age as constant variables.

The model fit was examined using Pearson and deviance criteria; statistics that measure the overall model performance were controlled. The adjustment method used in the logistic regression analysis was the least significant difference. Wald statistics, changes in log-likelihood, and odds ratios for predicting past month BAU were also calculated. All statistical analyses were performed using IBM SPSS Statistics 26.0 (SPSS Corp Inc.). Two-tailed statistical significance that was set at $p < 0.05$ was considered statistically significant.

Results

To measure the likelihood ratios of BAU in the past month among adults with MDE in all demographic groups, binary logistic regression analyses were conducted for sex, race, age, education level, marital status, and income, respectively. The binary logistic regression results confirm that the six demographic variables significantly predicting BAU risk in the past month among adults with MDE, age, and marital status demonstrated a substantially better fit than the intercept-only model. In contrast, sex, race, education, and income were found insignificant predictors of chances to develop BAU among adults with MDE ($p < 0.05$) (Table 1).

After adjustment for education, marital status, and income confounders, odds ratios for BAU across sex and race remained the same (Table 2). Furthermore, the Asian group continued to be the only racial group diagnosed with MDE that had lower chances to report BAU than Whites (Exp (B))=0.50 for Asian; $p < 0.05$; Tables 2 and 4). Similarly, after adjustment for confounders, all age groups continued to demonstrate a higher risk for BAU

Table 1 Test of the model effects of six predictors of binge alcohol use over the past 30 days among adults with MDE*

Tests of model effects				
Source	df1	df2	Wald F	Sig. ^{††}
Corrected model	19.00	32.00	7.50	.00
Intercept	1.00	50.00	40.12	.00
Sex	1.00	50.00	2.42	.12
Race	6.00	45.00	1.63	.15
Age group	3.00	48.00	15.58	.00
Education level	3.00	48.00	1.41	.25
Marital status	3.00	48.00	7.51	.00
Income	3.00	48.00	2.20	.10

*Major depressive episode

††Significance level set at $p < 0.05$

Table 2 Parameter estimates of demographics as predictors of binge alcohol use over the past 30 days among adults with MDE^{*,***}

Parameter estimates		B	Std. error	95% confidence interval		Hypothesis test		Exp (B)	95% confidence interval for Exp (B)	
Binge alcohol use past 30 days ^{**}	Parameter			Lower	Upper	t	df		Lower	Upper
Yes	Intercept	−1.43	.12	−1.68	−1.18	−11.49	50.00	.23	.18	.30
	Male	.13	.08	−.03	.30	1.55	50.00	1.14	.96	1.35
	Female	.00 [†]						1.00		
	Hispanic	.02	.12	−.21	.27	.23	50.00	1.02	.80	1.31
	Multiple race	.17	.24	−.30	.65	.72	50.00	1.18	.73	1.92
	Asian	−.69	.22	−1.14	−.24	−3.08	50.00	.49	.31	.78
	Native Pacific Islander	−.21	.84	−1.92	1.48	−.25	50.00	.80	.14	4.41
	Native American	.19	.33	−.48	.86	.56	50.00	1.20	.61	2.37
	Black	−.12	.15	−.43	.17	−.85	50.00	.87	.65	1.18
	White	.00 [†]						1.00		
	18–25	.74	.12	.49	.98	6.12	50.00	2.09	1.64	2.67
	26–34	.77	.13	.51	1.03	5.87	50.00	2.16	1.66	2.82
	35–49	.57	.11	.35	.80	5.11	50.00	1.78	1.42	2.23
	50 or older	.00 [†]						1.00		
	Less than high school	−.36	.17	−.71	−.01	−2.08	50.00	.69	.49	.98
	High school grad	−.12	.11	−.35	.09	−1.17	50.00	.87	.70	1.09
	Some college/associate degree	−.08	.08	−.25	.09	−.96	50.00	.92	.77	1.09
	College graduate	.00 [†]						1.00		
	Never been married	.52	.10	.30	.73	4.77	50.00	1.68	1.351	2.09
	Widowed	−.00	.26	−.53	.52	−.00	50.00	.99	.587	1.69
	Divorced/separated	.42	.12	.17	.67	3.42	50.00	1.53	1.193	1.96
	Married	.00 [†]						1.00		
	Less than \$20,000	−.21	.12	−.46	.03	−1.74	50.00	.80	.631	1.03

Table 2 (continued)

Parameter estimates		B	Std. error	95% confidence interval		Hypothesis test			95% confidence interval for Exp (B)	
Binge alcohol use past 30 days**	Parameter			Lower	Upper	t	df	Sig.††	Lower	Upper
	\$20,000–49,999	-.26	.10	-.47	-.05	-2.49	50.00	.01	.76	.623
	\$50,000–74,999	-.07	.14	-.36	.20	-.54	50.00	.59	.92	.697
	\$75,000 or more	.00†							1.00	1.23

* Author’s analysis of data from the 2018 National Survey for Drug Use and Health (NSDUH) for noninstitutionalized individuals with major depressive episodes (MDE) aged 18 and older (N = 6,999)

** Reference category: no binge alcohol use in the past 30 days

*** Major depressive episodes

† Set to zero because this parameter is redundant

†† Significance level $p < 0.05$

than adults aged ≥ 50 years (Exp (B)=2.10 for 18–25, Exp (B)=2.16 for 26–34, and Exp (B)=1.82 for 35–49; Table 4).

Logistic Regression Analyses

Among adults with MDE, the estimated coefficients were as follows. Across sex, males and females were equally likely to experience BAU in the past month, whereas across racial groups, only Asians were less likely than Whites to report BAU in the past month (Exp (B)=0.49 for Asian; $p < 0.05$; Table 3). Across age groups, all age groups were more likely to report BAU in the past month than adults aged ≥ 50 years (Exp (B)=2.09 for age group 18–25, Exp (B)=2.16 for age group 26–35, and Exp (B)=1.78 for age group 36–49; $p < 0.05$; Table 3). For education, only adults with less than a high school education were less likely to report BAU than college graduates, whereas adults with higher education levels had chances equal to those of college graduates to report BAU in the past month (Exp (B)=0.69 for less than high school, $p < 0.05$; Table 3). Moreover, adults who never married or were divorced/separated had significantly higher chances to report BAU than married adults (Exp (B)=1.68 for never married, Exp (B)=1.53 for divorced/separated; $p < 0.05$; Table 3), whereas widowed adults had chances equal to those of like married adults to report BAU in the past month. Among the different levels of income, only adults with income between \$20,000 and 49,000 had significantly lower chances to report BAU than those with a higher income of \$75,000 or more (Exp (B)=0.76 for adults with income between \$20,000 and 49,000; $p < 0.05$; Table 3). After adjustment for confounders, the Asian group continued to be the only racial group diagnosed with MDE that had lower chances to report BAU than Whites (Exp (B)=0.50 for Asian; $p < 0.05$; Table 4). Furthermore, when adjusting for confounders of education, marital status, and income, odds ratios for BAU across sex and race remained the same (Table 4).

Table 3 Test of the model effects of six predictors of binge alcohol use over the past 30 days among adults with MDE* with adjustment for demographic confounders

Tests of model effects				
Source	df1	df2	Wald F	Sig. ^{††}
Corrected model	13.00	38.00	8.70	.00
Intercept	1.00	50.00	20.46	.00
Sex	1.00	50.00	2.61	.11
Race	6.00	45.00	1.60	.16
Age group	3.00	48.00	18.03	.00
Education level	1.00	50.00	4.17	.04
Marital status	1.00	50.00	21.86	.00
Income	1.00	50.00	3.66	.06

*Major depressive episode

††Significance level set at $p < 0.05$

Table 4 Parameter estimates of demographics as confounders of binge alcohol use over the past 30 days among adults with MDE^{*,***}

Parameter estimates		B		Std. error	95% Confidence Interval		Hypothesis test		Exp (B)		95% Confidence interval for Exp (B)	
Binge alcohol use past 30 days ^{***}		Parameter			Lower	Upper	T	df	Sig ^{††}	Lower	Upper	Lower
Yes	Intercept	-1.47	.18	-1.84	-1.10	-7.99	50.00	.00	.23	.15	.33	
	Male	.13	.08	-.03	.30	1.61	50.00	.11	1.14	.96	1.36	
	Female	.00 [‡]							1.00			
	Hispanic	.03	.12	-.21	.27	.25	50.00	.80	1.03	.80	1.31	
	Multiple race	.18	.24	-.30	.66	.75	50.00	.45	1.19	.73	1.94	
	Asian	-.68	.22	-1.12	-.23	-3.05	50.00	.00	.50	.32	.79	
	Native Pacific Islander	-.26	.85	-1.97	1.44	-.30	50.00	.76	.77	.14	4.25	
	Native American	.19	.34	-.49	.88	.55	50.00	.58	1.21	.60	2.41	
	Black	-.12	.14	-.41	.17	-.81	50.00	.41	.88	.65	1.19	
	White	.00 [‡]							1.00			
	18–25	.74	.11	.52	.96	6.73	50.00	.00	2.10	1.68	2.63	
	26–34	.77	.12	.51	1.02	6.04	50.00	.00	2.16	1.67	2.79	
	35–49	.60	.11	.37	.82	5.35	50.00	.00	1.82	1.45	2.28	
	50 or older	.00 [‡]							1.00			
	Education level	.09	.04	.00	.18	2.04	50.00	.04	1.10	1.00	1.20	
	Marital status	-.15	.03	-.22	-.08	-4.67	50.00	.00	.85	.80	.91	
	Income	.07	.04	-.00	.15	1.91	50.00	.06	1.07	.99	1.16	

* Author's analysis of data from the 2018 National Survey for Drug Use and Health (NSDUH) for noninstitutionalized individuals with major depressive episodes (MDE) aged 18 and older (N = 6,999)

** Reference category: no binge alcohol use in the past 30 days

*** Major depressive episodes

† Set to zero because this parameter is redundant

†† Significance level $p < 0.05$

Discussion

The findings of this retrospective exploratory research confirmed that age and marital status significantly predicted BAU in the past month among adults with MDE. Adults with MDE at higher risk for BAU were under 50, with a college degree, never married, divorced/separated, and with a high-middle income level or higher. After adjusting for demographic confounders, odds ratios for BAU across sex, race, and age groups remained the same.

Our study results suggest that younger adults with high-middle income or higher, never been married, and divorced/separated diagnosed with MDE are at increased risk of developing BAU (Bracke et al., 2013; Bulloch et al., 2017; Kanny et al., 2018). Results suggest that other groups, including 50 years old or older, married, earn less than a college degree education, and less than high-middle income with MDE are at decreased risk of developing BAU. Further, the current study results show similar at-risk populations for BAU in the past month, such as adults with MDE across several demographic populations, with and without adjustment for confounders. After adjustment for confounders, equal chances for BAU between the two sexes and all racial groups were confirmed, except for Asians who were at a decreased risk for BAU compared to Whites (Nolen-Hoeksema & Harrell, 2002; Ross, 2004; Vaeth et al., 2017; Windle & Windle, 2014).

These results raise serious concerns about the younger population of adults under 50, with a college degree, never married, divorced/separated, and with a high-middle income level or higher with MDE who are at increased risk for BAU its severe consequences on their depressive symptoms. A study that examined binge drinking correlates among older adults used the NSDUH national datasets 2015–2017 to examine the prevalence of past-month binge alcohol use among adults aged 65 years or older. Researchers examine correlations such as past-month binge drinkers' characteristics, including demographics, substance use, severe mental illness, mental health treatment utilization, chronic disease, and emergency department (ED) use, which were compared to participants who reported past-month alcohol use without binge drinking. Results showed that binge drinkers were more likely to be male, have a higher prevalence of current tobacco and/or cannabis use, and have a lower prevalence of two or more chronic diseases (B. H. Han et al., 2019). Another work that used NSDUH dataset to examine health behaviors and depression examined alcohol initiation and risk for suicide by identifying the associations between the age of first alcohol use and suicide attempts among adolescents with a history of major depression. Scholars found a significant association between the age of first alcohol use and suicide attempts and suggest that early alcohol use initiation poses a risk for suicide attempts in youth (Bossarte & Swahn, 2011). These studies' results suggest that a broad range of demographic groups, particularly younger adults who binge drink, might be at risk for suicide attempts. The current study further elaborates on these results by revealing that age and marital status significantly predict BAU in the past month among adults with MDE, particularly adults under the age of 50, with a college degree, never married, divorced/separated, and with a high-middle income level or higher were populations at higher risk for BAU.

In conclusion, a broad range of demographic groups with MDE was either at increased risk or had an equal risk for BAU. The relationship between major depression and alcohol abuse is well established (Brière et al., 2014; Charlet & Heinz, 2017; Neupane, 2016). Our study results shed light on at-risk populations with MDE prone to develop BAU with and without adjustment for demographic confounders. The vicious cycle of depressant substance use such as alcohol and its impact on dopamine and

serotonin neurotransmitters result in associated unpleasant feelings, including depression, hangover, and exhaustion, considered alcohol withdrawal symptoms (Charlet et al., 2011). Repeated alcohol use can quickly progress to alcohol dependency, harm the brain, and lead to further depression (Bartels et al., 2002; Boschloo et al., 2013).

The major clinical implication from the present study is that tailoring clinical interventions for at-risk populations for BAU, i.e., the younger adults with high income, never been married, and divorced/separated who are diagnosed with MDE, can inform the assessment and treatment of alcohol abuse and MDE among those populations. Over the past few decades, there have been efforts to develop tailored evidence-based demographic-specific treatment programs; however, less research has focused on demographics such as age, race, education, income, and marital status in particular (Epstein et al., 2007; Huey et al., 2014; Kumpfer et al., 2008). Furthermore, the treatment effectiveness of these evidence-based treatments must assess and report demographic differences in treatment effectiveness, and as noted previously, few studies focus on intervention for binge drinking specifically; instead, it is treated as a type of addiction.

There have been, however, some substance use programs developed to target females in particular, and these gender-specific programs have been based on social learning and behavior theories (Kumpfer et al., 2008; Todd & Mullan, 2011), based on the assumption that the emerging females may be more vulnerable to social influences on binge drinking (Dir et al., 2017). Furthermore, understanding the difference between the risk for binge drinking among those with and without MDE may help determine the adult's broader risk of health risk behaviors and associated mental illness and alcohol abuse. This can help guide clinical decision-making regarding the type and level of mental health interventions the adult may require (DeVido & Weiss, 2012).

However, this study had some limitations. First, the NSDUH survey is cross-sectional; thus, no directionality or causality can be assumed between the study variables. Second, because the target population comprised non-institutionalized US civilians, a small proportion (approximately 3%) of the general population was excluded, including members in military duty and institutionalized individuals (e.g., hospitals, prisons, nursing homes, treatment centers). If the mental health status of these groups differs from that of non-institutionalized civilians, the NSDUH may be slightly inaccurate in terms of mental health estimates of the general population.

Third, the current study did not examine adults without MDE as a comparison group which could have shed light on chances for BAU among those without MDE who binge drink with adjustment for demographic covariates. Fourth, while this is the first study to control demographic confounders, it included only three. Future studies should examine additional potential confounders that impact the risk for BAU among the diverse demographic US population with major depression and other mental health disorders. Finally, the impact of the global COVID-19 pandemic may very well lead to higher levels of depression, particularly in countries like the USA that have been severely impacted by the pandemic and cause more significant difficulties for at-risk populations who may turn to alcohol use to alleviate depressive symptoms. Identifying these at-risk populations and tailoring specific treatments for them are areas of clinical necessity that this study begins to address.

A broad range of demographic groups with MDE was either at increased risk or equal risk for BAU. The relationship between major depression and alcohol abuse is well established (Brière et al., 2014; Charlet & Heinz, 2017; Neupane, 2016). The vicious cycle of depressant substance use such as alcohol and its impact on dopamine and serotonin neurotransmitters result in associated unpleasant feelings, including

depression, hangover, and exhaustion, considered alcohol withdrawal symptoms (Charlet et al., 2011). Repeated alcohol use can quickly progress to alcohol dependency, harm the brain, and lead to further depression (Bartels et al., 2002; Boschloo et al., 2013). Our study results shed light on at-risk populations with MDE prone to develop BAU with and without adjustment for demographic confounders.

Conclusions

This is the first study to use a national probability sample to predict the likelihood for BAU among adults with MDE with and without adjustments for confounders. Our findings reveal a broad range of at-risk populations for BAU among adults with MDE. For at-risk populations, clinical attention is required using tailored, focused interventions that address their unique substance abuse and mental health challenges and needs. The most effective behavioral health approach involves a combination of therapy and medication, and a trained professional should do a complete evaluation to diagnose and find the best treatment that works best for which population. Special attention must be paid to groups of adults under the age of 50, with a college degree, never married, divorced/separated, and with a high-middle income level or higher were at higher risk for BAU require tailored evidence-based treatment that meet the specific needs of the populations with MDE at risk for BAU.

Future research should consider examining additional potential confounders (e.g., availability of supportive networks, conflicts at home, comorbid physical and psychiatric conditions, employment) for BAU among all age groups, never married, separated/divorced, and other at-risk populations. Further research is also needed to examine at-risk populations for BAU among adults without major depression and adults with anxiety disorders and other mental disorders. More research is also needed to examine the risk for suicide among adults with comorbid major depression and BAU, the availability of tailored mental health programs, and mental health professionals specializing in comorbid major depression and alcohol addiction. Future studies should also consider exploring other potential covariates (e.g., availability of supportive networks and family support, comorbid physical and psychiatric conditions, and personal conflicts) for BAU risk among adults with and without MDE. Such research could enhance clinical assessment efforts for BAU risk in a broad range of populations, inform theoretical models, and improve alcohol treatment programs tailored specifically for individuals with behavioral health problems such as major depression and BAU.

Author Contribution The author is the sole contributor to the study conception, design, material preparation, data extraction, data analysis, and manuscript versions. The author read and approved the final manuscript.

Declarations

Ethical Approval This article does not contain any studies with human participants or animals performed by any authors.

Conflict of Interest The author declares no competing interests.

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