



ELSEVIER

Contents lists available at ScienceDirect

General Hospital Psychiatry

journal homepage: www.elsevier.com/locate/genhospsych

Research paper

Sex differences in binge drinking and suicide attempts in a nationally representative sample

Julie A. Kittel^{a,*}, Todd M. Bishop^{b,c}, Lisham Ashrafioun^{b,c}^a Department of Public Health Sciences, University of Rochester Medical Center, Rochester, NY, United States of America^b Department of Psychiatry, University of Rochester Medical Center, 300 Crittenden Blvd, Rochester, NY 14642, United States of America^c VA VISN 2 Center of Excellence for Suicide Prevention, Canandaigua VA Medical Center, Canandaigua, NY, United States of America

ARTICLE INFO

Keywords:

Suicide
Binge drinking
Sex
Alcohol

ABSTRACT

Objective: Prevalence of suicide continues to present a major public health problem, particularly among women. Identifying risk factors for suicide is vital to reduce the number of suicide deaths per year. Alcohol use is a well-known risk factor for suicidal behavior, but the association between binge drinking and suicide attempts across genders is less clear.

Methods: The current study used combined 2008–2014 National Survey on Drug Use and Health data (n = 269,078) to examine the association between binge drinking and suicidal ideation and suicide attempts across sex.

Results: Logistic regression analyses revealed that binge drinking was associated with suicide attempts in females (OR = 1.37, 95% CI: 1.09–1.73) but not in males (OR = 1.07, 95% CI: 0.80–1.43). Binge drinking was not associated with suicidal ideation in either males or females.

Conclusions: Identifying and addressing binge drinking in women may be useful as part of a suicide prevention strategy.

1. Introduction

Suicide continues to be a pressing public health problem as the 10th leading cause of death among the general population in the U.S. [1]. In 2017, more than 44,000 individuals died from suicide [1]. Men generally have higher rates of suicide than women [2], but between 1999 and 2014, rates of suicide for women increased by 45%, compared to 16% in men during the same time period [2]. This increase highlights the importance of identifying risk factors for suicide that may differ by sex.

The most robust predictors of suicide are suicidal ideation and history of prior suicide attempts [3–5]; the lifetime suicide rate of individuals with a prior suicide attempt was 27.5%, compared to 0.72% in the general population [4,6]. A long-term study of mood disorder patients found that those with a history of suicide attempts had 3.76 times the odds of suicide than those without prior suicide attempts over more than 30 years of follow-up [3]. The same study found that individuals with suicidal ideation had 2.34 times the odds of suicide compared to those without suicidal ideation [3].

Alcohol use is a well-known risk factor for suicidal ideation and

behavior across age groups (e.g., [7–11]). Of a sample of 10,950 suicide decedents across the US, 40.6% tested positive for alcohol at the time of death [12]. However, alcohol use can take on a number of different forms, including moderate use, problematic use (including binge drinking), and alcohol use disorder. The National Institute of Alcohol Abuse and Alcoholism defines binge drinking as consuming four or more alcoholic beverages within two hours in women, or five or more beverages in the same time period in men [13]. It is the most common form of excessive or problematic alcohol use among US adults, with approximately 27% of adults reporting binge drinking within the past month [14]. Alcohol use disorder is defined as a pattern of problematic alcohol use characterized by cravings, tolerance, and clinically significant impairment [15]. It is also important to note that binge drinking is not necessarily synonymous with alcohol use disorder (AUD), as most individuals who binge drink do not meet criteria for AUD [14].

Binge drinking is also more common in men than in women, with more than twice as many men reporting binge drinking as women [14,16]. Importantly, binge drinking is also associated with a number of negative health outcomes, including unintentional injuries, sexual

* Corresponding author at: Department of Public Health Sciences, University of Rochester Medical Center, 265 Crittenden Blvd, Rochester, NY 14642, United States of America.

E-mail addresses: Julie.kittel@urmc.rochester.edu (J.A. Kittel), Todd.bishop@va.gov (T.M. Bishop), Lisham.ashrafiou@va.gov (L. Ashrafioun).

<https://doi.org/10.1016/j.genhospsych.2019.06.011>

Received 4 April 2019; Received in revised form 24 June 2019; Accepted 26 June 2019

0163-8343/© 2019 Elsevier Inc. All rights reserved.

assault, cancer, liver disease, and suicide [11,17,18]. For example, studies among high school and college students found that binge drinking is associated with increased suicidal ideation and suicide attempts in high school and college students [19,20]. This may be due to the nature of the rapid onset of acute intoxication in binge drinking, as acute intoxication is more strongly associated with suicidal ideation and behavior than chronic alcohol use [21,22]. Acute intoxication is also associated with more violent means of suicide, including use of firearms [22]. In a nationally representative sample between 2008 and 2012, Glasheen et al. [17] found that binge drinking was associated with suicidal ideation in men and women who had not experienced a major depressive episode (MDE), but not in those who had [17]. Similarly, binge drinking was associated with suicide attempts in women without MDE but not in men [17].

While Glasheen and colleagues provide valuable insight into the association of binge drinking and suicidality by sex, further research is needed to see if binge drinking per se is associated with suicidality or if binge drinking is part of a larger pattern of problematic drinking and that is driving the association. The current study aimed to replicate findings by Glasheen et al. [17] using more recent data, and to expand the findings by controlling for additional covariates, including alcohol use disorder, frequency of alcohol use, and general health status. By including these covariates, we account for the broader pattern of alcohol consumption to further elucidate the association of binge drinking specifically and suicidality. We used nationally representative data from 2008 to 2014 to examine how the association between suicidal ideation and attempts and binge drinking differs between males and females.

2. Method

2.1. Data source and participants

Data from the 2008 through 2014 National Survey on Drug Use and Health (NSDUH) were used in the current analyses and accessed through SAMHSA's data website (Substance Abuse and Mental Health Services Administration, 2018).[47] Data from the NSDUH is collected through interviews conducted using a random sample of households across the United States. Only respondents aged 18 years or older were included in the analyses. The pooled 2008–2014 NSDUH dataset consisted of 391,753 respondents, with 121,526 excluded because they were younger than 18 years of age. An additional 4795 respondents were excluded because a response for one or more of the covariates was missing ($n = 2291$ for suicide planning or suicide attempts; $n = 56$ for general health rating, $n = 2448$ for major depressive episode in past year), leaving a total of 269,078 participants included in the final analyses. This study received exempt status from the University of Rochester Institutional Review Board.

2.2. Variables

2.2.1. Suicide-related variables

Three items were used to assess suicidal ideation, suicide planning, and suicide attempts within the past year. Participants were asked whether they had seriously thought about trying to kill themselves within the past 12 months (i.e., suicidal ideation). If the response was yes, participants were asked if they had made any plans to kill themselves (i.e., suicide planning). If the response to the planning item was yes, then participants were asked if they had tried to kill themselves within the past 12 months (i.e., suicide attempt). Suicidal ideation and suicide attempts were included in the analyses.

2.2.2. General health

Participants were asked to rate their overall health level using the responses poor (5), fair, good, very good, and excellent (1).

2.2.3. Depression and substance use disorders

Past-year major depressive episode was identified if a participant endorsed five of the nine Diagnostic and Statistical Manual (DSM-IV; [15]) criterion items for the past year. To assess substance use disorders, participants were asked if they had ever used hallucinogens, inhalants, stimulants, marijuana, sedatives, tranquilizers, or prescription pain relievers in a way that was “not prescribed” or “only for the experience or feeling it caused.” The survey clarified that pain relievers did not refer to over-the-counter medications. If the participant indicated that they had used substances, an additional set of questions were asked that mapped on to the DSM-IV criteria for substance use disorders. If participants endorsed at least one abuse criteria or at least three dependence criterion, they were coded as having a substance use disorder. Participants were also asked if they used any type of tobacco in the past year.

2.2.4. Alcohol use

Participants were asked the total number of days they used alcohol in the past year, which was then recoded into a categorical variable (None, 1–11 days, 12–49 days, 50–99 days, 100–299 days, and 300–365 days). For binge drinking, participants were asked on how many days in the past month they had five or more drinks on one occasion. This was recoded to a dichotomous variable.

2.2.5. Sociodemographics

Data were collected regarding respondent age (categorized in the dataset as 18 to 25, 26 to 34, 35 to 49, 50 to 64, and 65 years and older), sex (male-female), education (Less than high school, high school, some college/associates degree, college graduate) and race/ethnicity (White, Black/African American, Native American/Alaskan, Asian, Native Hawaiian/Other Pacific Islander, More than one race, and Hispanic [all races were specified as non-Hispanic]).

2.3. Data analysis

Weighted prevalences of binge drinking, suicidal ideation and behavior and related covariates were calculated. Unadjusted logistic regression analyses were conducted to assess the bivariate relationships between past month binge drinking as the independent variable and suicidal ideation, and suicide attempts each as dependent variables in separate models for both males and females. Adjusted models were run to account for key covariates including sociodemographics, overall health, depression, substance use disorders, tobacco use, and alcohol use. Complex sampling was accounted for using sample weights.

3. Results

3.1. Binge drinking and suicidal ideation and behavior among the overall sample

In the full sample, 5.4% ($n = 14,631$) reported suicidal ideation in the past year, 1.7% ($n = 4458$) reported making a suicide plan in the past year, and 0.9% ($n = 2363$) reported making at least one suicide attempt in the past year. Past month binge drinking was reported in 32.3% ($n = 86,898$). Demographic, physical health, mental health, alcohol- and suicide-related characteristics are reported by sex in Table 1.

3.2. Unadjusted association between binge drinking and suicidal ideation and suicide attempts by sex

In unadjusted logistic regression, binge drinking was significantly associated with greater odds of suicidal ideation and suicide attempts in both men and women. For men, odds ratios (OR) were 1.31 (95% Confidence Interval [CI] 1.19–1.44) for suicidal ideation and 1.58 (95% CI = 1.31–1.92) for suicide attempts. In women, ORs were 1.87 (95% CI: 1.73–2.02) for suicidal ideation and 2.97 (95% CI: 2.46–3.60) for

Table 1
Participant characteristics by sex (n = 260,078).

	All (n = 269,078)		Men (n = 125,416)		Women (n = 143,662)	
	Weighted %	% error	Weighted %	% error	Weighted %	% error
Age						
18–25 years old	14.7%	0.1%	15.3%	0.1%	14.1%	0.1%
26–34 years old	15.8%	0.1%	16.2%	0.2%	15.4%	0.2%
35–49 years old	26.7%	0.1%	27.2%	0.2%	26.3%	0.2%
50–64 years old	25.3%	0.2%	25.4%	0.3%	25.2%	0.3%
65 years or older	17.5%	0.2%	15.9%	0.2%	18.9%	0.2%
Race						
Non-Hispanic White	67.1%	0.2%	67.4%	0.3%	66.8%	0.3%
Non-Hispanic Black	11.6%	0.2%	10.8%	0.2%	12.3%	0.2%
Non-Hispanic Native American/Alaskan Native	0.5%	0.0%	0.5%	0.0%	0.5%	0.0%
Non-Hispanic Native Hawaiian/Pacific Islander	0.3%	0.0%	0.3%	0.0%	0.3%	0.0%
Non-Hispanic Asian	4.8%	0.1%	4.6%	0.1%	4.9%	0.1%
Non-Hispanic more than one race	1.3%	0.0%	1.3%	0.1%	1.3%	0.1%
Hispanic	14.4%	0.1%	15.1%	0.2%	13.8%	0.2%
Education						
Less than high school	14.3%	0.1%	15.3%	0.2%	13.5%	0.2%
High school	30.1%	0.2%	30.3%	0.2%	29.8%	0.2%
Some college/associates degree	26.2%	0.2%	24.7%	0.2%	27.7%	0.2%
College graduate	29.4%	22.7	29.7%	0.3%	29.0%	0.2%
Marital status						
Married	53.1%	0.2%	55.2%	0.3%	51.2%	0.2%
Widowed	6.0%	0.1%	2.9%	0.1%	8.9%	0.1%
Divorced/separated	13.9%	0.1%	12.0%	0.2%	15.7%	0.2%
Never been married	26.9%	0.2%	29.8%	0.2%	24.2%	0.2%
Overall health rating						
Excellent	22.6%	0.2%	22.5%	0.2%	22.7%	0.2%
Very good	36.2%	0.1%	36.5%	0.2%	36.0%	0.2%
Good	27.7%	0.1%	28.0%	0.2%	27.4%	0.2%
Fair/poor	13.5%	0.1%	13.0%	0.2%	13.9%	0.2%
Used tobacco in last year	33.8%	0.2%	41.8%	0.2%	26.4%	0.2%
Illicit drug abuse or dependence in last year	2.6%	0.0%	3.5%	0.1%	1.7%	0.0%
Alcohol days in past year						
1–11 days	14.7%	0.1%	11.4%	0.1%	17.7%	0.2%
12–49 days	18.4%	0.1%	17.9%	0.2%	18.8%	0.2%
50–99 days	11.2%	0.1%	12.1%	0.2%	10.3%	0.1%
100–299 days	21.8%	0.1%	27.0%	0.2%	17.0%	0.2%
300–365 days	4.6%	0.1%	6.2%	0.1%	3.1%	0.1%
Non-user/no use in past year	29.4%	0.2%	25.4%	0.2%	33.1%	0.3%
Binge drinking in past month	24.8%	0.1%	33.3%	0.2%	16.9%	0.2%
Major depressive episode in past year	6.7%	0.1%	4.9%	0.1%	8.4%	0.1%
Suicidal ideation in the past year	3.8%	0.1%	3.7%	0.1%	4.0%	0.1%
Suicide plan in the past year	1.1%	0.0%	1.0%	0.0%	1.1%	0.0%
Suicide attempt in past year	0.5%	0.0%	0.4%	0.0%	0.6%	0.0%
Survey year						
2008	13.8%	0.1%	13.8%	0.2%	13.8%	0.2%
2009	14.0%	0.1%	14.0%	0.2%	14.0%	0.2%
2010	14.1%	0.1%	14.2%	0.2%	14.1%	0.2%
2011	14.3%	0.1%	14.3%	0.2%	14.3%	0.2%
2012	14.5%	0.1%	14.4%	0.2%	14.5%	0.2%
2013	14.6%	0.1%	14.6%	0.2%	14.6%	0.2%
2014	14.8%	0.1%	14.7%	0.2%	14.8%	0.1%

suicide attempts.

3.3. Adjusted association between binge drinking and suicidal ideation and suicide attempts by sex

Adjusted analyses of the association between binge drinking and suicidal ideation and attempts are presented in Tables 2 and 3, respectively. Adjusted analyses accounted for key covariates, including alcohol use disorder, mental health, physical health, and socio-demographic characteristics. Alcohol use disorder (AUD) was associated with suicidal ideation and suicide attempts in both men and women, but binge drinking was only associated with increased odds of suicide attempt in women (OR = 1.31, 95% CI: 1.01–1.71). Binge drinking was not significantly associated suicide attempts in men, or with suicidal ideation in either men or women.

4. Discussion

The purpose of the current study was to examine the role of sex in the association between binge drinking and suicidal ideation and suicide attempts. We found a significant association between suicide attempts and binge drinking among women, such that women who binge drank in the past month had 31% increase in the odds of a suicide attempt than those who did not binge drink after controlling for key covariates, including alcohol use disorder. This association was not found in men. There was an association between AUD and both suicidal ideation and suicide attempts in men and women. This suggests that while AUD may increase risk for suicidal thoughts and behaviors across genders, the effect of binge drinking on suicidal behavior is specific to women.

These findings are important because few studies have examined binge drinking as a risk factor for suicide in adults, and the association

Table 2
Adjusted odds of suicidal ideation among males and females.

Characteristic	Males (n = 125,416)		Females (n = 143,662)	
	OR	95% CI	OR	95% CI
Race				
Non-Hispanic White	Ref		Ref	
Non-Hispanic Black	0.67	0.57–0.80	0.82	0.72–0.93
Non-Hispanic Native American/Alaskan Native	1.07	0.65–1.76	1.34	0.86–2.09
Non-Hispanic Native Hawaiian/Pacific Islander	1.20	0.43–3.38	0.59	0.39–0.89
Non-Hispanic Asian	0.80	0.62–1.04	1.15	0.86–1.53
Non-Hispanic more than one race	1.22	0.85–1.77	1.14	0.88–1.49
Hispanic	0.61	0.52–0.72	0.70	0.61–0.80
Health				
Excellent	Ref		Ref	
Very good	1.27	1.10–1.47	1.33	1.16–1.52
Good	1.68	1.42–1.99	1.72	1.51–1.97
Fair/poor	2.66	2.22–3.20	2.54	2.16–3.00
Age				
18–25 years old	2.64	2.00–3.48	3.37	2.68–4.23
26–34 years old	1.79	1.35–2.38	1.99	1.56–2.53
35–49 years old	1.88	1.45–2.44	1.95	1.58–2.42
50–64 years old	1.56	1.20–2.02	1.43	1.14–1.78
65 years or older	Ref		Ref	
Education				
Less than high school	1.14	0.95–1.36	1.01	0.89–1.15
High school	1.10	0.93–1.31	1.03	0.90–1.17
Some college/associates degree	1.13	0.97–1.32	1.07	0.95–1.20
College graduate	Ref		Ref	
Marital status				
Married	Ref		Ref	
Widowed	1.78	1.23–2.57	1.23	0.88–1.71
Divorced/separated	1.32	1.10–1.59	1.64	1.45–1.86
Never been married	1.44	1.25–1.67	1.35	1.21–1.52
Survey year				
2008	Ref		Ref	
2009	1.01	0.84–1.22	1.03	0.87–1.23
2010	1.08	0.87–1.35	1.02	0.87–1.19
2011	0.97	0.81–1.16	1.05	0.90–1.24
2012	1.04	0.87–1.23	1.05	0.87–1.27
2013	1.12	0.94–1.33	1.11	0.94–1.30
2014	1.13	0.96–1.32	1.06	0.92–1.24
Tobacco use in past year	1.02	0.91–1.14	1.27	1.13–1.42
Illicit drug use/dependence in past year	2.17	1.87–2.52	2.25	1.92–2.64
Alcohol use in past year				
No use/non-user	Ref		Ref	
1–11 days	1.01	0.94–1.30	1.07	0.95–1.21
12–49 days	1.02	0.86–1.21	1.08	0.94–1.23
50–99 days	0.83	0.70–0.97	1.07	0.91–1.25
100–299 days	0.87	0.71–1.08	1.00	0.84–1.18
300–365 days	0.97	0.75–1.24	1.17	0.82–1.59
Major depressive episode in past year	13.61	11.93–15.53	10.28	9.36–11.30
Alcohol use disorder in past year	1.93	1.67–2.24	1.78	1.53–2.07
Binge drinking days in past 30 days	0.93	0.80–1.09	0.98	0.87–1.11

between substance use and suicide in women is understudied (e.g., [23]). Sex differences in binge drinking and suicide attempts may be driven by a number of factors. One possible explanation is that men are more likely to die from a suicide attempt compared to women (e.g., [24,25]), and thus would not be captured in these data. Similarly, men may be less likely to report a suicide attempt because of cultural or gender norms [26]. Additionally, because the 2008–2014 NSDUH surveys considered binge drinking to be “five or more drinks in one sitting” for both men and women, rather than four for women and five for men, these data may be capturing the only the most severe female binge

Table 3
Adjusted odds of suicide attempts among males and females.

Characteristic	Males		Females	
	OR	95% CI	OR	95% CI
Race				
Non-Hispanic White	Ref		Ref	
Non-Hispanic Black	1.28	0.92–1.79	1.40	1.07–1.85
Non-Hispanic Native American/Alaskan Native	2.28	1.05–4.95	1.29	0.79–2.11
Non-Hispanic Native Hawaiian/Pacific Islander	0.15	0.05–0.40	1.38	0.35–5.48
Non-Hispanic Asian	0.85	0.45–1.61	2.74	1.51–4.95
Non-Hispanic more than one race	1.71	0.83–3.55	1.29	0.86–1.94
Hispanic	1.07	0.76–1.49	0.95	0.73–1.23
Health				
Excellent	Ref		Ref	
Very good	0.93	0.64–1.37	1.21	0.88–1.66
Good	1.41	0.98–2.04	1.77	1.28–2.47
Fair/poor	1.95	1.27–3.01	4.02	2.63–6.14
Age				
18–25 years old	2.44	1.17–5.08	6.66	2.68–16.54
26–34 years old	1.32	0.63–2.79	2.99	1.19–7.54
35–49 years old	1.46	0.75–2.87	2.44	1.01–5.94
50–64 years old	1.21	0.56–2.62	1.73	0.71–4.24
65 years or older	Ref		Ref	
Education				
Less than high school	2.90	1.57–4.51	1.94	1.24–3.02
High school	2.29	1.50–3.48	1.45	0.99–2.12
Some college/associates degree	1.34	0.86–2.09	1.56	1.07–2.29
College graduate	Ref		Ref	
Marital status				
Married	Ref		Ref	
Widowed	1.60	0.64–3.99	1.47	0.72–3.04
Divorced/separated	1.79	1.17–2.74	1.85	1.30–2.62
Never been married	1.79	1.25–2.54	1.10	0.82–1.50
Survey year				
2008	Ref		Ref	
2009	0.94	0.63–1.39	0.70	0.47–1.01
2010	1.14	0.70–1.84	0.71	0.45–1.13
2011	0.93	0.58–1.48	1.00	0.65–1.55
2012	0.97	0.61–1.56	0.99	0.69–1.42
2013	1.05	0.72–1.55	1.02	0.66–1.57
2014	0.92	0.60–1.41	0.90	0.61–1.34
Tobacco use in past year	1.25	0.97–1.60	1.36	1.07–1.71
Illicit drug use/dependence in past year	2.14	1.64–2.78	2.01	1.58–2.56
Alcohol use in past year				
No use/non-user	Ref		Ref	
1–11 days	1.07	0.67–1.70	0.80	0.59–1.08
12–49 days	1.33	0.87–2.01	0.87	0.66–1.15
50–99 days	1.23	0.70–2.16	1.14	0.77–1.69
100–299 days	0.89	0.58–1.37	1.05	0.74–1.50
300–365 days	0.64	0.37–1.11	1.61	0.79–3.30
Major depressive episode in past year	8.72	6.80–11.18	8.07	6.35–10.26
Alcohol use disorder in past year	2.18	1.69–2.82	1.76	1.22–2.55
Binge drinking in past 30 days	0.93	0.70–1.25	1.31	1.01–1.71

drinkers.

Another potential explanation is the increase of impulsivity and impaired executive function observed during acute alcohol use. Prior research suggests that acute alcohol intoxication impairs planning [27] and working memory [28]. Interestingly, female binge drinkers have shown greater cognitive impairments compared to female non-binge drinkers, but this trend is not evident in males [28]. Alcohol use also decreases inhibitory control and increases impulsivity [29–31]. Women also report increased functional impairment across a variety of domains, including social and psychiatric functioning [32], and may be more likely to self-medicate for psychiatric disorders [33,34]. Further, binge drinking is associated with sexual assault in women [35,36], which is in turn associated with suicide attempts [37].

Acute alcohol use is a stronger risk factor for unplanned suicidal behavior than premeditation, ideation, and intent [38,39]. This may explain why binge drinking is not associated with suicidal ideation in

our sample. Other covariates, such as depression, age, illicit drug use, and alcohol use disorder are bigger drivers of suicidal ideation compared to binge drinking, which may explain the lack of association between binge drinking and ideation. In contrast to binge drinking, chronic alcohol use is more strongly associated with suicidal ideation rather than suicidal behavior [40,41]. Our findings support this association, as alcohol use disorder is more strongly associated with suicidal ideation than suicide attempts in both men and women.

4.1. Limitations

The current study had a number of limitations. Data on binge drinking for the past month were collected, while data on suicide attempts were collected for the past year. As a result, the suicide attempts may have occurred prior to the reported binge drinking. We cannot conclusively say that the past month drinking pattern was indicative of the past year drinking pattern, though research suggests they are likely to be similar [42–44]. Additionally, the survey did not assess number of or lifetime suicide attempts, so we are unable to account for this in the analyses. Additionally, NSDUH does not include any data on suicide deaths. Acute alcohol use is associated with firearm use in suicide attempts (e.g., [22]), which is more likely to result in death than other methods [12], thus those who died by suicide using firearms after binge drinking would not be included in the analyses. There were also a number of individuals who failed to respond to questions about suicide attempt, suicide plans, and depression. This may be due to mental health stigma or social desirability. However, less than 1% did not respond on each of these items. The final year of the data used is five years old, which may limit generalizability, but since suicide attempts among women have continued to increase, we feel that these analyses are still relevant. Finally, as previously mentioned, the binge drinking assessment used the same definition of binge drinking for men and women, though the National Institute of Alcohol Abuse and Alcoholism uses a different definition for men and women [13]. Future research should assess the longitudinal relationship between binge drinking and suicide attempts in men and women, using the NIAAA accepted definition of binge drinking. Strengths of the current study are the nationally representative nature of the data, and the inclusion of data across nearly a decade.

These findings may have important implications for screening and assessment of both alcohol use and suicide risk, especially in primary care or women's health clinics. Screening for problematic or heavy alcohol use in primary care settings is already recommended by the U.S. Preventive Services Task Force (US Preventive Services Task [45]), and a recent study suggests that 96% of providers are screening for alcohol misuse [46]. Educating clinicians and providers on the link between binge drinking and suicide risk in women and providing suicide risk assessments for women who report binge drinking may help women get appropriate psychiatric care before a suicide attempt.

Declaration of Competing Interest

None. This project was not supported by any grant funding.

Acknowledgements

Authors TB and LA are employees of the United States (U.S.) Department of Veterans Affairs (VA); the views or opinions expressed herein do not necessarily represent those of the VA or the U.S. Government. No funding sources were involved in this research.

References

- [1] Heron M. Deaths: leading causes for 2016. Hyattsville, MD: National Center for Health Statistics; 2018.
- [2] Curtin SC, Warner M, Hedegaard H. Increase in suicide in the United States, 1999–2014. 2016. [No. 241]. Hyattsville, MD.
- [3] Angst F, Stassen HH, Clayton PJ, Angst J. Mortality of patients with mood disorders: follow-up over 34–38 years. *J Affect Disord* 2002;68(2–3):167–81.
- [4] Harris EC, Barraclough B. Suicide as an outcome for mental disorders. A meta-analysis. *Br J Psychiatry* 1997;170:205–28.
- [5] Suominen K, Isometsä E, Suokas J, Haukka J, Achte K, Lönnqvist J. Completed suicide after a suicide attempt: a 37-year follow-up study. *Am J Psychiatry* 2004;161(3):562–3.
- [6] Busch KA, Fawcett J, Jacobs DG. Clinical correlates of inpatient suicide. *J Clin Psychiatry* 2003;64(1):14–9.
- [7] Bartels SJ, Coakley E, Oxman TE, Constantino G, Oslin D, Chen H, et al. Suicidal and death ideation in older primary care patients with depression, anxiety, and at-risk alcohol use. *Am J Geriatr Psychiatry* 2002;10(4):417–27.
- [8] Beck AT, Steer RA, Kovacs M, Garrison B. Hopelessness and eventual suicide: a 10-year prospective study of patients hospitalized with suicidal ideation. *Am J Psychiatry* 1985;142(5):559–63. <https://doi.org/10.1176/ajp.142.5.559>.
- [9] Grant BF, Hasin DS. Suicidal ideation among the United States drinking population: results from the National Longitudinal Alcohol Epidemiologic Survey. *J Stud Alcohol* 1999;60(3):422–9.
- [10] Schilling EA, Aseltine Jr. RH, Glanovsky JL, James A, Jacobs D. Adolescent alcohol use, suicidal ideation, and suicide attempts. *J Adolesc Health* 2009;44(4):335–41. <https://doi.org/10.1016/j.jadohealth.2008.08.006>.
- [11] Wilcox HC, Conner KR, Caine ED. Association of alcohol and drug use disorders and completed suicide: an empirical review of cohort studies. *Drug Alcohol Depend* 2004;76(Suppl):S11–9. <https://doi.org/10.1016/j.drugaldep.2004.08.003>.
- [12] Stone DM, Simon TR, Fowler KA, Kegler SR, Yuan K, Holland KM, et al. Vital signs: trends in state suicide rates – United States, 1999–2016 and circumstances contributing to suicide – 27 states, 2015. *MMWR Morb Mortal Wkly Rep* 2018;67(22):617–24. <https://doi.org/10.15585/mmwr.mm6722a1>.
- [13] National Institute for Alcohol Abuse and Alcoholism. NIAAA council approves definition of binge drinking. *NIAAA Newsl.* 2004;3(3).
- [14] Esser MB, Hedden SL, Kanny D, Brewer RD, Gfroerer JC, Naimi TS. Prevalence of alcohol dependence among US adult drinkers, 2009–2011. *Prev. Chronic Dis* 2014;11:E206 <https://doi.org/10.5888/pcd11.140329>.
- [15] American Psychiatric Association. Diagnostic and statistical manual of mental disorders. 4th ed. Washington, DC: American Psychiatric Association; 2000.
- [16] Kanny D, Naimi TS, Liu Y, Lu H, Brewer RD. Annual total binge drinks consumed by U.S. adults, 2015. *Am J Prev Med* 2018;54(4):486–96. <https://doi.org/10.1016/j.amepre.2017.12.021>.
- [17] Glasheen C, Pemberton MR, Lipari R, Copello EA, Mattson ME. Binge drinking and the risk of suicidal thoughts, plans, and attempts. *Addict Behav* 2015;43:42–9. <https://doi.org/10.1016/j.addbeh.2014.12.005>.
- [18] World Health Organization. Global status report on alcohol and health—2018. Geneva: World Health Organization; 2018.
- [19] Miller JW, Naimi TS, Brewer RD, Jones SE. Binge drinking and associated health risk behaviors among high school students. *Pediatrics* 2007;119(1):76–85.
- [20] Schaffer M, Jeglic EL, Stanley B. The relationship between suicidal behavior, ideation, and binge drinking among college students. *Arch Suicide Res* 2008;12(2):124–32. <https://doi.org/10.1080/13811110701857111>.
- [21] Cheripitel CJ, Borges GL, Wilcox HC. Acute alcohol use and suicidal behavior: a review of the literature. *Alcohol Clin Exp Res* 2004;28(5 Suppl):18S–28S.
- [22] Kaplan MS, McFarland BH, Huguet N, Conner K, Caetano R, Giesbrecht N, et al. Acute alcohol intoxication and suicide: a gender-stratified analysis of the National Violent Death Reporting System. *Inj Prev* 2013;19(1):38–43. <https://doi.org/10.1136/injuryprev-2012-040317>.
- [23] Chapman SL, Wu LT. Suicide and substance use among female veterans: a need for research. *Drug Alcohol Depend* 2014;136:1–10. <https://doi.org/10.1016/j.drugaldep.2013.11.009>.
- [24] Hawton K. Sex and suicide. Gender differences in suicidal behaviour. *Br J Psychiatry* 2000;177:484–5.
- [25] Moscicki EK. Gender differences in completed and attempted suicides. *Ann Epidemiol* 1994;4(2):152–8.
- [26] Canetto SS, Sakinofsky I. The gender paradox in suicide. *Suicide Life Threat Behav* 1998;28(1):1–23.
- [27] Weissenborn R, Duka T. Acute alcohol effects on cognitive function in social drinkers: their relationship to drinking habits. *Psychopharmacology* 2003;165(3):306–12. <https://doi.org/10.1007/s00213-002-1281-1>.
- [28] Townshend JM, Duka T. Binge drinking, cognitive performance and mood in a population of young social drinkers. *Alcohol Clin Exp Res* 2005;29(3):317–25.
- [29] Dougherty DM, Marsh-Richard DM, Hatzis ES, Nouvion SO, Mathias CW. A test of alcohol dose effects on multiple behavioral measures of impulsivity. *Drug Alcohol Depend* 2008;96(1–2):111–20. <https://doi.org/10.1016/j.drugaldep.2008.02.002>.
- [30] Marczinski CA, Combs SW, Fillmore MT. Increased sensitivity to the disinhibiting effects of alcohol in binge drinkers. *Psychol. Addict. Behav.* 2007;21(3):346–54. <https://doi.org/10.1037/0893-164X.21.3.346>.
- [31] Marinkovic K, Rickenbacher E, Azma S, Artsy E. Acute alcohol intoxication impairs top-down regulation of Stroop incongruity as revealed by blood oxygen level-dependent functional magnetic resonance imaging. *Hum Brain Mapp* 2012;33(2):319–33. <https://doi.org/10.1002/hbm.21213>.
- [32] McHugh RK, Votaw VR, Sugarman DE, Greenfield SF. Sex and gender differences in substance use disorders. *Clin Psychol Rev* 2018;66:12–23. <https://doi.org/10.1016/j.cpr.2017.10.012>.
- [33] Lehavot K, Stappenbeck CA, Luterek JA, Kaysen D, Simpson TL. Gender differences in relationships among PTSD severity, drinking motives, and alcohol use in a comorbid alcohol dependence and PTSD sample. *Psychol. Addict. Behav.* 2014;28(1):42–52. <https://doi.org/10.1037/a0032266>.

- [34] McHugh RK, Devito EE, Dodd D, Carroll KM, Potter JS, Greenfield SF, et al. Gender differences in a clinical trial for prescription opioid dependence. *J Subst Abuse Treat* 2013;45(1):38–43. <https://doi.org/10.1016/j.jsat.2012.12.007>.
- [35] McCauley JL, Calhoun KS, Gidycz CA. Binge drinking and rape: a prospective examination of college women with a history of previous sexual victimization. *J Interpers Violence* 2010;25(9):1655–68. <https://doi.org/10.1177/0886260509354580>.
- [36] Stappenbeck CA, Fromme K. A longitudinal investigation of heavy drinking and physical dating violence in men and women. *Addict Behav* 2010;35(5):479–85. <https://doi.org/10.1016/j.addbeh.2009.12.027>.
- [37] Ullman SE, Brecklin LR. Sexual assault history and suicidal behavior in a national sample of women. *Suicide Life Threat Behav* 2002;32(2):117–30.
- [38] Baca-Garcia E, Diaz-Sastre C, Basurte E, Prieto R, Ceverino A, Saiz-Ruiz J, et al. A prospective study of the paradoxical relationship between impulsivity and lethality of suicide attempts. *J Clin Psychiatry* 2001;62(7):560–4.
- [39] Bagge CL, Conner KR, Reed L, Dawkins M, Murray K. Alcohol use to facilitate a suicide attempt: an event-based examination. *J Stud Alcohol Drugs* 2015;76(3):474–81.
- [40] Conner KR, Bagge CL, Goldston DB, Ilgen MA. Alcohol and suicidal behavior: what is known and what can be done. *Am J Prev Med* 2014;47(3 Suppl 2):S204–8. <https://doi.org/10.1016/j.amepre.2014.06.007>.
- [41] Hufford MR. Alcohol and suicidal behavior. *Clin Psychol Rev* 2001;21(5):797–811.
- [42] Carey KB, Carey MP, Maisto SA, Henson JM. Temporal stability of the timeline followback interview for alcohol and drug use with psychiatric outpatients. *J Stud Alcohol* 2004;65(6):774–81.
- [43] Sobell LC, Agrawal S, Sobell MB, Leo GI, Young LJ, Cunningham JA, et al. Comparison of a quick drinking screen with the timeline followback for individuals with alcohol problems. *J Stud Alcohol* 2003;64(6):858–61.
- [44] Vakili S, Sobell LC, Sobell MB, Simco ER, Agrawal S. Using the Timeline Followback to determine time windows representative of annual alcohol consumption with problem drinkers. *Addict Behav* 2008;33(9):1123–30. <https://doi.org/10.1016/j.addbeh.2008.03.009>.
- [45] Force USPST. Screening and behavioral counseling interventions in primary care to reduce alcohol misuse: recommendation statement. *Ann Intern Med* 2004;140(7):554–6.
- [46] Tan CH, Hungerford DW, Denny CH, McKnight-Eily LR. Screening for alcohol misuse: practices among U.S. primary care providers, DocStyles 2016. *Am J Prev Med* 2018;54(2):173–80. <https://doi.org/10.1016/j.amepre.2017.11.008>.
- [47] Substance Abuse and Mental Health Services Administration. Administration Substance abuse and mental health data archive. 2018 <https://www.datafiles.samhsa.gov/>, Accessed date: 31 July 2018.