**The Effects of Binge Drinking on Mental Health Among Military Veterans**

Charlene Wolthers

National University

ANA 625: Categorical Data Methods

Dr. Kevin Duffy-Deno

July 1, 2024

**Objective**

High rates of binge drinking can lead to a cascade of negative health outcomes, including liver disease, cardiovascular issues, neurological damage, and increased symptoms of depression, anxiety, and insomnia. For veterans, alcoholism is not uncommon as many use it as a coping mechanism for trauma experienced during their service. Alcohol dependence can worsen existing mental health conditions, making it more challenging for veterans to achieve long-term recovery and stability. The objective of this study is to investigate the association between binge drinking and mental health among the military veteran community, while controlling for sex, general health, smoking, health insurance, and exercise.

**Introduction**

In 2018, one in six U.S. adults reported engaging in binge drinking within the past 30 days. Of those who binge drank, 25% did so at least once a week on average, and another 25% consumed at least eight drinks per binge session (Bohm., et al, 2021). Binge drinking has contributed to declines in life expectancy. Over time, binge drinking can lead to high blood pressure, strokes, weaker immune system, and alcohol use disorder (AUD). There are high rates of alcohol abuse among veterans. Veterans of every age group are more likely to binge drink than their civilian counterparts (Shane, 2023).

A report by the RAND Corporation highlights how younger veterans, in particular, exhibit the highest rates of binge drinking. This study found that post-9/11 veterans consistently have higher rates of binge drinking compared to pre-9/11 veterans. Specifically, nearly 37% of post-9/11 veterans reported binge drinking in the past month, a significantly higher rate than their older counterparts (Schuler, 2024). The 2021 National Survey on Drug Use and Health highlights that veterans face significant challenges with substance use, including binge drinking, and those with PTSD or other mental health issues often use alcohol as a coping mechanism, exacerbating their conditions​ (SAMHSA, 2021). There exists a complex relationship between PTSD and alcohol misuse among veterans. Veterans with PTSD are significantly more likely to develop alcohol use disorders. Binge drinking can worsen mental health conditions, strain relationships, and increase risks of self-harm and suicide​​.

To support existing studies on the topic, a 2022 national survey of adults residing in every state and participating US territory will be used. The goal of this study is to highlight the need for increased support and resources to help veterans access the care they need. Understanding the extent and impact of binge drinking on veterans' mental health can inform policymakers and healthcare providers. It can help in the allocation of resources to support mental health and substance abuse treatment programs tailored for veterans, ensuring they receive the necessary care to improve their quality of life.​

**Methods**

***Data***

This study focuses on the relationship between binge drinking and mental health among the military veteran population in the United Staes. A sample of this population is drawn from the BRFSS 2022 survey. The Behavioral Risk Factor Surveillance System (BRFSS) is a state-based telephone survey that collects data on various health outcomes, health-related risk behaviors, preventive service usage, and chronic conditions from adults residing in every state and participating US territories. The BRFSS conducts over 400,000 interviews with adults annually, making it the largest ongoing health survey system globally (CDC, About BRFSS).

The BRFSS survey receives broad sponsorship from numerous divisions within the CDC's National Center for Chronic Disease Prevention and Health Promotion, various other CDC centers, and several federal agencies. These agencies include the Health Resources and Services Administration, Administration on Aging, Department of Veterans Affairs, and the Substance Abuse and Mental Health Services Administration (CDC, About BRFSS).

This study makes use of the 2022 BRFSS survey. Of the 445,132 survey participants, 10% satisfied the sample requirements for this study: military veteran, lived in one of the 50 states or us territories and had complete data for all variables.

***Model***

The research objective of this study is to investigate the association between binge drinking and mental health. The model can be summarized by the following:

MENTHLTH = f(BINGE, SEX, HLTHINS, SMOKER, GENHLTH, EXERCISE)

MENTHLTH represents whether a survey participant reported their mental health was poor in the past 30 days (1 = Poor; 0 = Good); BINGE represents Whether the participant reported they binge drank (males having five or more drinks in one occasion, females having four or more drinks on one occasion) in the past 30 days ( 1 = yes; 0 = no); SEX is the reported biological sex of the survey respondent ( 1= Female; 0 = Male); HLTHINS represents whether a respondent has some form of health insurance (1 = yes; 0 = no); SMOKER is coded as 0, 1, 2, depending on whether the survey participant reported they have not smoked at least 100 cigarettes in their lifetime (SMOKER = 0 , “Never”), or having smoked at least 100 cigarettes in their lifetime and currently do not smoke (SMOKER = 1, “Former”), or having smoked at least 100 cigarettes in their lifetime and now smoke some days or every day (SMOKER = 3, “Current”). GENHLTH represents a participant’s health status (1 = Good or Better Health; 0 = Fair or Poor Health); EXERCISE represents whether a participant had physical activity or exercise during the past 30 days other than their regular job (1 = yes; 0 = no).

***Statistical Analysis***

The statistical analysis performed in this study consists of both tests of association and logic regression. Pearson X2 tests of association will be performed between the control variables and the exposure variable and are represented in Table 1 along with univariate statistics. Similar tests will be performed between the control and exposure variables and the outcome variable, presented in Table 2 along with univariate statistics. Logistic regression is used to estimate adjusted odds ratios and their 95% confidence intervals for the outcome variable (MENTHLTH) with respect to the exposed (BINGE) and control variables (SEX, HLTHINS, SMOKER, GENHLTH, and EXERCISE), presented in Table 3.

With respect to the regression analysis, tests for confounding between the exposure and control variables are performed, goodness of fit statistics are reported, and interactions between the exposure and control variables are investigated. All statistical analysis is performed using SAS.

**Results**

Of the 445,132 survey participants, 45,461 (10%) had complete data for the objective. The demographic characteristics of this population are compared in Table 1 with respect to the exposure variable, whether the participant engages in binge drinking (BINGE).

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Table 1. Characteristics of 45,461 BRFSS 2022 participants by binge drinking category. | | | | | | | |
|  | Population | | Binge - No | | Binge - Yes | |  |
| Variable | N | % | n | % | n | % | p value \* |
|  | 45,461 | 100.0% | 39,575 | 87.1% | 5,886 | 12.9% |  |
| **Sex** |  |  |  |  |  |  |  |
| Male | 40,258 | 88.6% | 34,952 | 88.3% | 5,306 | 90.1%% |  |
| Female | 5,203 | 11.4% | 4,623 | 11.7% | 580 | 9.9% | <0.0001 |
| **Health Insurance** |  |  |  |  |  |  |  |
| No | 942 | 2.1% | 741 | 1.9% | 201 | 3.4% |  |
| Yes | 44,519 | 97.9% | 38,834 | 98.1% | 5,685 | 96.6% | <0.0001 |
| **Smoker** |  |  |  |  |  |  |  |
| Never | 20,638 | 45.4% | 18,526 | 46.8% | 2,112 | 35.9% |  |
| Former | 19,167 | 42.2% | 16,750 | 42.3% | 2,417 | 41.1% |  |
| Current | 5,656 | 12.4% | 4,299 | 10.9% | 1,357 | 23.0% | <0.0001 |
| **General Health** |  |  |  |  |  |  |  |
| Fair / Poor | 9,265 | 20.4% | 8,330 | 21.0% | 935 | 15.9% |  |
| Good / Better | 36,196 | 79.6% | 31,245 | 79.0% | 4,951 | 84.1% | <0.0001 |
| **Exercise** |  |  |  |  |  |  |  |
| No | 10,987 | 24.2% | 9,818 | 24.8% | 1,169 | 19.9% |  |
| Yes | 34,474 | 75.8% | 29,757 | 75.2% | 4,717 | 80.1% | <0.0001 |
| \* p values based on Pearson chi-square test of association | | | | | | | |

Of the entire population, 11.4% were female, 97.9% had health insurance, 42.2% formerly smoked, 12.4% currently smoke, 79.6% had good or better health, and 75.8% exercise. There were proportionately fewer females than expected who reported binge drinking (9.9% vs 11.4%; p<0.0001). With respect to health insurance, there were proportionately fewer participants with health insurance than expected who reported binge drinking (96.6% vs 97.9%; p<0.0001). With respect to smoking, there were proportionately fewer former smokers than expected who reported binge drinking (41.1% vs 42.2%; p<0.0001), and proportionately more current smokers than expected who reported binge drinking (23.0% vs 12.4%; p<0.0001). With respect to general health, there were proportionately more participants with good or better health than expected who reported binge drinking (84.1% vs 79.6%; p<0.0001). With respect to exercise, there were proportionately more exercisers than expected who reported binge drinking (80.1% vs 75.8%; p<0.0001).

The demographic characteristics of this population are compared in Table 2 with respect to the outcome variable, mental health (MENTHLTH).

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Table 2. Characteristics of 45,461 BRFSS 2022 participants by mental health status. | | | | | | | |
|  | Population | | Mental Health – Good | | Mental Health – Poor | |  |
| Variable | N | % | n | % | n | % | p value \* |
|  | 45,461 | 100.0% | 40,182 | 88.4% | 5,279 | 11.6% |  |
| **Binge** |  |  |  |  |  |  |  |
| No | 39,575 | 87.1% | 35,228 | 87.7% | 4,347 | 82.3% |  |
| Yes | 5,886 | 12.9% | 4,954 | 12.3% | 932 | 17.7% | <0.0001 |
| **Sex** |  |  |  |  |  |  |  |
| Male | 40,258 | 88.6% | 35,996 | 89.6% | 4,262 | 80.7% |  |
| Female | 5,203 | 11.4% | 4,186 | 10.4% | 1,017 | 19.3% | <0.0001 |
| **Health Insurance** |  |  |  |  |  |  |  |
| No | 942 | 2.1% | 739 | 1.8% | 203 | 3.8% |  |
| Yes | 44,519 | 97.9% | 39,443 | 98.2% | 5,076 | 96.2% | <0.0001 |
| **Smoker** |  |  |  |  |  |  |  |
| Never | 20,638 | 45.4% | 18,618 | 46.3% | 2,020 | 38.3% |  |
| Former | 19,167 | 42.2% | 17,039 | 42.2% | 2,128 | 40.3% |  |
| Current | 5,656 | 12.4% | 4,525 | 11.3% | 1,131 | 21.4% | <0.0001 |
| **General Health** |  |  |  |  |  |  |  |
| Fair / Poor | 9,265 | 20.4% | 6,766 | 16.8% | 2,499 | 47.3% |  |
| Good / Better | 36,196 | 79.6% | 33,416 | 83.2% | 2,780 | 52.7% | <0.0001 |
| **Exercise** |  |  |  |  |  |  |  |
| No | 10,987 | 24.2% | 9,054 | 22.5% | 1,933 | 36.6% |  |
| Yes | 34,474 | 75.8% | 31,128 | 77.5% | 3,346 | 63.4% | <0.0001 |
| \* p values based on Pearson chi-square test of association  \*\* Sums may not total 100% due to rounding. | | | | | | | |

Overall, 11.6% of the population had reported poor mental health. There were proportionately more females than expected who reported poor mental health (19.3% vs 11.4%; p<0.0001). With respect to health insurance, proportionately fewer participants with health insurance reported poor mental health (96.2% vs 97.9%; p<0.0001). There were proportionately fewer former smokers than expected who reported poor mental health (40.3% vs 42.2%; p<0.0001), and proportionately more current smokers than expected who reported poor mental health (21.4% vs 12.4%; p<0.0001). With respect to general health, there were proportionately fewer participants with good or better health than expected who reported poor mental health (52.7% vs 79.6%; p<0.0001). There were proportionately fewer exercisers than expected who reported poor mental health (63.4% vs 75.8%; p<0.0001). With respect to the exposure variable, BINGE, there were proportionately more binge drinkers than expected who reported poor mental health (17.7% vs 12.9%; p<0.0001).

Adjusted odds ratios for mental health with respect to the exposure variable and control variables obtained from logistic regression are presented in Table 3.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Table 3. Logistic regression analysis comparing the adjusted odds ratio of mental health status in 45,461 BRFSS 2022 participants. | | | | | | |
|  | Mental Health – Good | | Mental Health – Poor | | OR\* | 95% CI |
| Variable | n | % | n | % |  |  |
|  | 40,182 | 88.4% | 5,279 | 11.6% | ----- | ----- |
| **Binge** |  |  |  |  |  |  |
| No | 35,228 | 87.7% | 4,347 | 82.3% | ----- | ----- |
| Yes | 4,954 | 12.3% | 932 | 17.7% | 1.669 | 1.538-1.812 |
| **Sex** |  |  |  |  |  |  |
| Male | 35,996 | 89.6% | 4,262 | 80.7% | ----- | ----- |
| Female | 4,186 | 10.4% | 1,017 | 19.3% | 2.352 | 2.170-2.549 |
| **Health Insurance** |  |  |  |  |  |  |
| No | 739 | 1.8% | 203 | 3.8% | ----- | ----- |
| Yes | 39,443 | 98.2% | 5,076 | 96.2% | 0.519 | 0.439 – 0.615 |
| **Smoker** |  |  |  |  |  |  |
| Never | 18,618 | 46.3% | 2,020 | 38.3% | ----- | ----- |
| Former | 17,039 | 42.2% | 2,128 | 40.3% | 1.016 | 0.949 - 1.087 |
| Current | 4,525 | 11.3% | 1,131 | 21.4% | 1.645 | 1.509 – 1.792 |
| **General Health** |  |  |  |  |  |  |
| Fair / Poor | 6,766 | 16.8% | 2,499 | 47.3% | ----- | ----- |
| Good / Better | 33,416 | 83.2% | 2,780 | 52.7% | 0.234 | 0.219 – 0.249 |
| **Exercise** |  |  |  |  |  |  |
| No | 9,054 | 22.5% | 1,933 | 36.6% | ----- | ----- |
| Yes | 31,128 | 77.5% | 3,346 | 63.4% | 0.755 | 0.706 – 0.807 |
| \* 95% confidence intervals are for reported odds ratios.  \*\* Sums may not total 100% due to rounding. | | | | | | |

Females are at higher odds of reporting poor mental health when compared to males after controlling for health insurance, smoking, general health, and exercise (OR = 2.352; 95% CI = 2.170 – 2.549). Those with health insurance had lower odds of reporting poor mental health comparted to those who do not have health insurance after controlling for sex, smoking, general health, and exercise (OR = 0.519; 95% CI = 0.439 – 0.615). Those who formerly smoked had higher odds of reporting poor mental health compared to those who have never smoked after controlling for sex, health insurance, general health, and exercise (OR = 1.016; 95% CI = 0.949 – 1.087), but it was not statistically significant. Those who currently smoke had higher odds of reporting poor mental health than those who never smoked after controlling for sex, health insurance, general health, and exercise (OR = 1.64; 95% CI = 1.509 – 1.792). Those who reported good or better general health had lower odds of reporting poor mental health compared to those who reported fair or poor general health after controlling for sex, health insurance, smoking, and exercise (OR = 0.234; 95% CI = 0.219 – 0.249). Exercisers had lower odds of reporting poor mental health compared to non-exercisers after controlling for sex, health insurance, smoking, and general health (OR = 0.755; 95% CI = 0.706 – 0.807). With respect to the exposure variable, binge drinkers had higher odds of reporting poor mental health compared to those who do not binge drink after controlling for sex, health insurance, smoking, general health, and exercise (OR = 1.669; 95% CI = 1.538 – 1.812).

The AUC statistic for the logistic regression was 0.718 and the rescaled R-squared was 0.128, indicating a model that is on the borderline between poor and acceptable discrimination according to Hosmer and Lemeshow’s general rule. A goodness-of-fit deviance test yielded a p-value of 0.0003, indicating that the null hypothesis that the interaction beta = 0 cannot be rejected. The Hosmer-Lemeshow (HL) test is an alternative to the goodness-of-fit test. The HL chi-square statistic is 24.666 with a p-value of 0.0004. Thus, the null hypothesis that the model fits the data well cannot be rejected and no further investigation into interactions is warranted.

Finally, we tested for confounding between the exposure variable BINGE and the control variables SEX, HLTHINS, SMOKER, GENHLTH, and EXERCISE. Employing a 10% rule for whether the base BINGE adjusted ORs are changed by more than 10% with the removal of either SEX, HLTHINS, SMOKER, GENHLTH, and EXERCISE, we find that the removal of SEX, results in an OR change of approximately 71% (1.669 to 0.488). The removal of HLTHINS results in an OR change of approximately 69% (1.669 to 0.521). The removal of SMOKER results in an OR change of approximately 65% (1.669 to 0.586) and the removal of GENHLTH results in an OR change of approximately 12% (1.669 to 1.466). Thus, SEX, HLTHINS, SMOKER, and GENHLTH are all confounders with respect to the relationship between BINGE and MENTHLTH. The removal of EXERCISE did not yield evidence of a confounding relationship. Although no confounding relationship was detected for EXERCISE, its coefficient is statistically significant, so it will be retained in the model as well.

**Strengths and Limitations**

***Strengths***

This study was based on data obtained by the Behavioral Risk Factor Surveillance System, administered and supported by CDC's Population Health Surveillance Branch, under the Division of Population Health at CDC’s National Center for Chronic Disease Prevention and Health Promotion. The BRFSS is the largest continuously conducted health survey system in the world and is currently sponsored by federal agencies, such as the Health Resources and Services Administration, Administration on Aging, Department of Veterans Affairs, and Substance Abuse and Mental Health Services Administration.

The BRFSS is designed to collect sample information on the target population, namely, adults residing in various states across the US. Data weighting ensures that the sample data accurately represents the population from which it was drawn. BRFSS data weights incorporate the survey design and population characteristics. The BRFSS weighting methodology consists of two components: 1) design factors, or design weight, and 2) demographic adjustments of the population through iterative proportional fitting or raking. The design weight addresses the probability of selection and corrects for nonresponse bias and coverage errors.

In terms of strengths related to analytical methods, this study investigates the relationship between binge drinking and mental health status while controlling for several potential confounders. Controlling for confounders in statistical analysis enhances the accuracy and reliability of results by reducing bias and ensuring the observed effects are due to the variables being studied, not external factors. This practice improves the internal validity and credibility of the findings. Another key strength related to analysis is the use of deviance goodness of fit. This measure allows for an accurate assessment of how well the statistical model fits the observed data, ensuring the model's adequacy. Additionally, it facilitates the comparison of models, enabling the identification of the model that best captures the underlying patterns in the data.

***Limitations***

One limitation of this study is the sample size, which was reduced to 45,461 participants from the original 450,000 survey participants in the BRFSS. This reduction in sample size may impact the generalizability of the findings, as the smaller sample might not capture the full diversity of the larger population. Additionally, the uneven stratification of binary groups poses a challenge; for instance, approximately 89% of the sample were male while only 11% were female, and 98% had insurance compared to only 2% who did not. These imbalances can lead to biased results and limit the study's ability to generalize findings across different subgroups.

Furthermore, the recoding of variables introduced additional limitations. For example, the original BRFSS variable \_MENT14D, which had three categories (0 days, 1-13 days, and 14+ days), was grouped into two categories (0-13 days and 14+ days) for the new variable MENTHLTH. Similarly, the original variable \_SMOKER3 was recoded from four categories (never smoked, former smoker, current smoker - some days, and current smoker - every day) to three categories (never, former, and current). These changes in categorization may oversimplify the data and overlook important nuances, potentially affecting the study's outcomes and interpretations.

Additionally, the method of data collection and other study design factors introduce further limitations. The BRFSS data was collected via phone surveys, which may not reach certain demographics and could lead to response bias. The survey also focused on the last 30 days rather than a longer timeframe, which may not fully capture seasonal or longer-term variations in behaviors and health outcomes. Moreover, as a complete case study, all missing data were removed, which might have excluded relevant information and further reduced the sample size and representativeness. These factors collectively limit the scope and applicability of the study's findings.

**Conclusion**

The objective of this study is to quantify the relationship between exposure to binge drinking and mental health status, while controlling for sex, health insurance, smoking, general health, and exercise. The population of interest for this study was U.S. military veterans. The study employs data for a sample of this population from the 2022 BRFSS survey of over 445,000 Americans on their health-related risk behaviors, chronic health conditions, and use of preventative services.

This study finds that that the odds of having poor mental health are 1.7 times higher for those who binge drink vs those who do not binge drink. Additionally, the odds of females having poor mental health were higher compared to the odds for males (2.4 times higher) and those who currently smoke had higher odds of having poor mental health than those who never smoked (1.6 times higher).

The study advances our knowledge of the relationship between binge drinking and mental health by accounting for the influence of several control variables, and focusing on the impact that binge drinking has on mental health status specifically. The results clearly indicate that U.S. veterans who engage in bring drinking are at a higher risk of having poor mental health and that policies and strategies that aim to help veterans struggling with binge drinking and mental health is warranted. These findings can also be used as justification for additional funds to be allocated toward resources to support mental health and substance abuse treatment programs tailored for veterans, ensuring that they receive the necessary care to improve their quality of life.

Despite the current study’s findings, there is ample opportunity for future research. Additional control variables should be considered from the BRFSS in future efforts, as this study only employed five control variables. Other risk factors like income, housing, and mental health diagnoses should be accounted for in later studies. Redefining the outcome variable for this study to capture more detailed levels of mental health could enhance the analysis. One approach could be to use an ordinal variable with categories such as "poor," "fair," "good," and "excellent," allowing for more nuanced insights into the relationship between variables like binge drinking and mental health. Alternatively, treating mental health as a continuous variable, if the data permits, would provide even finer granularity and could be analyzed with linear regression models. Another sophisticated method involves creating a latent variable through factor analysis or item response theory, which combines multiple survey items into a comprehensive measure of mental health.

The current study faced significant information loss, suggesting that future research should either limit the number of raw survey items used to construct variables or adopt a less conservative encoding methodology to better preserve data.

**References**

Bohm MK, Liu Y, Esser MB, et al. Binge Drinking Among Adults, by Select Characteristics and State — United States, 2018. MMWR Morb Mortal Wkly Rep 2021;70:1441–1446. DOI: <http://dx.doi.org/10.15585/mmwr.mm7041a2>.

Center for Disease Control and Prevention (CDC). (2014). About BRFSS. <https://www.cdc.gov/brfss/about/index.htm>

Centers for Disease Control and Prevention (CDC). (2022). Behavioral Risk Factor Surveillance System (BRFSS). Codebook. <https://www.cdc.gov/brfss/annual_data/annual_2022.html>

Centers for Disease Control and Prevention (CDC). (2022). Behavioral Risk Factor Surveillance System (BRFSS). Overview. <https://www.cdc.gov/brfss/annual_data/annual_2022.html>

SAMHSA, Center for Behavioral Statistics and Quality. 2021 National Survey on Drug Use and Health: Among the Veteran Population Aged 18 or Older. —[cited Jun 25]. Available from: https://www.samhsa.gov/data/sites/default/files/reports/rpt41854/NSDUH%20highlighted%20population%20slides/For%20NSDUH%20highlighted%20population%20slides/2021NSDUHPopulationSlidesVeterans050323.pdf#:~:text=URL%3A%20https%3A%2F%2Fwww.samhsa.gov%2Fdata%2Fsites%2Fdefault%2Ffiles%2Freports%2Frpt41854%2FNSDUH%2520highlighted%2520population%2520slides%2FFor%2520NSDUH%2520highlighted%2520population%2520slides%2F2021NSDUHPopulationSlidesVeterans050323.pdf%0AVisible%3A%200%25%20

Schuler, Megan S., Eric Robinson, Justin W. Lee, Teague Ruder, Gilad Wenig, Carrie M. Farmer, Jessica Phillips, and Rajeev Ramchand, Alcohol and Substance Use Among U.S. Veterans, RAND Corporation, IG-A1363-4, 2023. As of June 23, 2024: https://www.rand.org/pubs/infographics/IGA1363-4.html

Shane, L. (2023, October 26). Binge Drinking Alcohol Abuse Remains Significant Challenge for Vets. Military Times. <https://www.militarytimes.com/veterans/2023/10/26/binge-drinking-alcohol-abuse-remains-significant-challenge-for-vets/>