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A Cluster Analysis of the Co-occurrence of Alcohol Consumption and Depressive Symptoms

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Abstract

This study will use cluster analysis to empirically derive the patterns of alcohol consumption and depression symptoms among these respondents by forming segments of respondents with similar alcohol use, depression symptoms, and socio-demographic characteristics among veterans and non-veterans. The empirical work of this study is based on the 2011-2012 National Health and Nutrition Examination Survey (NHANES). Because the choice of clustering variables includes a combination of nominal, ordinal, and interval-ratio scaled measures, a two-step clustering within SPSS was employed to segment individuals based on drinking frequency (treated as a continuous variable), age (treated as continuous variable), depression symptoms (likert scores), sex, race/ethnicity, marital status, and veteran status (dichotomies). Findings suggest that alcohol use and depression co-occur more commonly than expected. Individuals with more frequent manifestation of depressive symptoms tend to consume more alcohol. To mitigate the negative consequences of alcohol use and depression, there remains a pressing need for there remains a pressing need for an integrated treatment of both alcohol use and depression that simultaneously treat these two disorders.

Keywords: Alcohol consumption; Post-traumatic stress disorder; Borderline personality disorder; Clinical depression; Sexual trauma

Introduction

Depression and alcohol consumption commonly co-occur together. Generalized depressive and anxiety disorders are frequently associated with substance use disorders [1]. Depression may be a significant trigger for alcohol use because alcohol may act pharmacologically in the brain similar to those of antidepressant drugs. As such, depressed individuals may self-medicate by drinking to temporally alleviate aversive depressive symptoms such as anxiety, depression, and other forms of psychological distress. If they continue to drink to alleviate their symptoms, these individuals may eventually develop alcohol dependence, the need to increase the amount and frequency of drinking to achieve the same desired effect [2]. They may also abuse alcohol just to alleviate their symptoms [2]. Depression may also occur as a consequence of withdrawal from alcohol [1].

A distinguish legacy of research have focused on the impact of deployment on aversive depressive symptoms such as post-traumatic stress disorder (PSTD) [3-6], borderline personality disorder (BPD) [7], clinical depression [8], and sexual trauma [9-11] has also been highlighted. The co-occurrence of alcohol abuse and mental health conditions among veterans [12-14] has also been examined. Other researchers have also attempted to compare veterans and non-veterans alcohol use [15-19]. However, studies that focus on the adverse effects of deployment on mental health and the co-occurrence of alcohol abuse and mental health conditions tend to focus solely on veterans. The same factors that contribute to alcohol use disorder can also contribute to various depressive disorders. Nevertheless, no studies have attempted to form segments of respondents with similar alcohol use, depression symptoms, and socio-demographic characteristics with respect to veterans and non-veterans.

In order to fill in the research gaps, this study seeks to identify the cluster subtypes of alcohol use and depression among 2011-2012 NHANES respondents and to determine whether there is heterogeneity in the patterns of alcohol consumption and depression among veterans and non-veterans. Cluster analysis will be used to form segments of respondents with similar alcohol use, depression symptoms, and socio-demographic characteristics (i.e. age, sex, race/ethnicity, and marital status). A secondary goal of this study is to determine whether the theory of marriage protection is applicable to alcohol use and depression for veterans, non-veterans, or both. Results from this study will help policy makers tailor their substance use and mental health interventions, prevention, and rehabilitation programs according to the patterns of alcohol consumption, the extent of these depression symptoms, as well as the socio-demographic characteristics of the different segments of these respondents.

Previous researchers have identified that non-Hispanic Whites, young adults, and those who are divorced or separated appear to be more likely to develop both alcohol abuse and depression. Non-Hispanic Whites start drinking at an earlier age [20] and are more likely than Blacks to increase alcohol consumption over time [21]. They also have higher odds of alcohol dependence than their Blacks, Asians, and Hispanics counterparts [22]. Likewise, the prevalence of major depressive disorder is significantly higher among Whites than in African Americans and Mexican Americans [23]. There is some evidence that aging is associated with a faster increase in abstinence [24] as well as an intrinsic reduction in the susceptibility to anxiety and depression [25].

A distinguished legacy of research has also demonstrated that adult males consume more alcohol and have more alcohol-related problems than females [26-28]. In contrast, females are more susceptible to depression. A recent study found that male veterans are more likely to engage in hazardous drinking than female veterans [29]. Another

recent study found that women were more likely to be distressed by combat experiences involving violence but male veterans who were sexually traumatized had more depressive symptoms [30].

Researchers have also acknowledged the potential protective mechanism of marriage as early as the early 1990s [31]. According to them, marriage is not only a resource for social and emotional support but also confers other financial, legal, and material advantages [31]. As such, being married is a way of reducing the risk of substance abuse and gaining increased protection against adverse mental health outcomes. A related finding also revealed that spouses, especially wives, tend to play a greater role in the social control of health behaviors and maintaining contact with friends and family [32]. To my knowledge, only five of these studies [33-36] explicitly tested the potential roles of marriage protection on subsequent alcohol use and depression among the military personnel.

Data

The empirical work of this study is based on the 2011-2012 National Health and Nutrition Examination Survey (NHANES). NHANES was conducted by Centers for Disease Control and Prevention (CDC). The main purpose of NHANES was to assess the health and nutritional status of adults and children in the United States. About 5,000 individuals throughout the U.S. participate in the survey each year. In addition to information on demographic, socioeconomic, dietary, and health-related questions, individuals were interviewed in-depth about their medical, dental, and physiological health. These in-depths interviews were supplemented with physical examinations. The analysis is limited to individuals whose information on drinking frequency, age, various depression symptoms, gender, race/ethnicity, marital status, and veteran status is available. The final analysis sample consists of 3,151 individuals.

Questions pertaining to depression symptoms were obtained from the Depression Screener Questionnaire (DPQ) in NHANES which is also called the Patient Health Questionnaire (PHQ). The PHQ is a version of the primary care evaluation of mental disorders (PRIME-MD) [37]. Depression symptoms are self-reported assessment based on the nine DSM-IV signs and symptoms for depression based on the following survey questions:

• How often do you feel like you have little interest in doing things?

• How often to you feel down, depressed, or hopeless?

• How often do you have trouble sleeping or sleep too much?

• How often do you feeling tired or have little energy?

• How often do you have poor appetite or overeat?

• How often do you feel bad about yourself?

• How often do you have trouble concentrating on things?

• How often do you think that you would be better off dead?

For each survey question pertaining to depression, individuals responded on a five-point scale from 1= Not at all, 2=Several days, 3=More than half the days, and 4=Nearly everyday. Sex is formulated as males and females. The PHQ is a reliable and valid depression diagnostic measure and has been used in a lot of primary care settings [37].

Race/ethnicity is represented by Non-Hispanic Whites, Non-Hispanic Blacks, Hispanics, and Other. Marital status is represented by married / living with a partner, widowed, divorced/separated, and never married. Veteran status is indicated by the survey question that asked respondents whether they have served in the military in their lifetime.

Method

Cluster analysis (also called data segmentation) is both an exploratory data analysis and an unsupervised learning tool for classifying and assigning observations (people, cities, countries, regions, events, etc.) to their distinctive group or cluster based on similar characteristics in such a way that observations in the same cluster are more similar to one another than to those in different clusters. It is an exploratory data analysis tool because prediction is not involved in this type of technique. It is an unsupervised learning tool because clusters are not predetermined.

Because the choice of clustering variables includes a combination of nominal, ordinal, and interval-ratio scaled measures, clustering techniques that can only accommodate interval-ratio or continuous variables, hierarchical agglomerative clustering and k-means clustering are inappropriate. Hence, two-step clustering within SPSS was employed to segment individuals based on drinking frequency (treated as a continuous variable), age (treated as continuous variable), depression symptoms, sex, race/ethnicity, marital status, and veteran status. It combines characteristics of k-means clustering and hierarchical agglomerative clustering approaches in a two-step algorithm. In the first stage, a sequential clustering algorithm akin to the k-means approach to scan the observations one by one. Observations are merged to form initial cluster based on a designated distance criterion. In the second stage, hierarchical agglomerative clustering is performed to sequentially combine the initial clusters into optimal number of desired clusters. Goodness-of-fit measures like the Akaike's Information Criterion (AIC) or the Bayes Information Criterion (BIC) are used to determine the number of optimal clusters to retain.

Since previous researchers have consistently found that veterans have significantly higher rates of heavy drinking [1], two separate but identical cluster analyses — one for veterans and the other for non-veterans were estimated to determine whether the distribution of alcohol use, depressive symptoms, as well as other demographic characteristics (sex, race/ethnicity, and marital status) differ between veterans and non-veterans.

Results

As reported in Tables 1 and 2, cluster analysis yielded two distinct clusters based on alcohol use and depressive symptoms for both veterans and non-veterans. For both veterans and non-veterans, a somewhat higher percentage of individuals in both clusters are non-Hispanic Whites. Likewise, a somewhat higher percentage of individuals in both clusters are either married or living with a partner. On average, veterans are somewhat older than non-veterans. The majority of individuals (over 90 percent) in the veterans sample are males.

For both veterans and non-veterans, the first segment is characterized by individuals with relatively higher daily alcohol use and more frequent manifestation of depressive symptoms. For non-veterans, nearly 60 percent of the individuals in this segment are females. For both veterans and non-veterans, the percentages of divorced and separated as well as never married individuals are relatively higher in this segment. In contrast, the second segment is characterized by individuals with moderate alcohol use and less frequent or virtually non-existent manifestation of depressive symptoms. For veterans and

Variables	Segment 1 (N=141)	Segment 2 (N=348)	All (N=489)
# drinks per day	3.13 (2.90)	2.47 (2.17)	2.66 (2.42)
Age	53.43 (15.57)	63.09 (15.13)	60.30 (15.86)
Have little interest in doing things			
Not at all	44.68%	96.26%	81.39%
Several days	34.75%	2.59%	11.86%
More than half the days	13.48%	0.57%	4.29%
Nearly everyday	7.09%	0.57%	2.45%
Feeling down, depressed, or hopeless			
Not at all	45.39%	97.99%	82.82%
Several days	37.59%	1.72%	12.07%
More than half the days	9.22%	0.29%	2.86%
Nearly everyday	7.80%	0.00%	2.25%
Trouble sleeping or sleeping too much			
Not at all	28.37%	78.74%	64.21%
Several days	33.33%	15.23%	20.45%
More than half the days	17.02%	3.16%	7.16%
Nearly everyday	21.28%	2.87%	8.18%
Feeling tired or having little energy			
Not at all	11.35%	82.18%	61.76%
Several days	49.65%	13.22%	23.72%
More than half the days	15.60%	3.16%	6.75%
Nearly everyday	23.40%	1.44%	7.77%
Poor appetite or overeating			
Not at all	43.26%	97.13%	81.60%
Several days	38.30%	2.01%	12.47%
More than half the days	12.06%	0.57%	3.89%
Nearly everyday	6.38%	0.29%	2.04%
Feeling bad about yourself			
Not at all	65.25%	98.85%	89.16%
Several days	19.86%	0.86%	6.34%
More than half the days	9.93%	0.29%	3.07%
Nearly everyday	4.96%	0.00%	1.43%
Trouble concentrating on things			
Not at all	58.16%	97.41%	86.09%
Several days	24.82%	2.01%	8.59%
More than half the days	9.22%	0.29%	2.86%
Nearly everyday	7.80%	0.29%	2.45%
Variables	Segment 1 (N=141)	Segment 2 (N=348)	All (N=489)
Thought you would be better off dead			
Not at all	89.36%	97.71%	96.73%
Several days	8.51%	0.29%	2.66%
More than half the days	1.42%	0.00%	0.41%
Nearly everyday	0.71%	0.00%	0.20%
Sex			
Male	92.20%	94.54%	93.87%
Female	7.80%	5.46%	6.13%
Race/Ethnicity			
Non-Hispanic White	49.65%	68.10%	62.78%
Non-Hispanic Black	29.79%	17.24%	20.86%
Hispanic	17.02%	12.64%	13.91%
Other	3.55%	2.01%	2.45%
Marital Status			
Married / Living with partner	56.74%	73.28%	68.51%
Widowed	7.80%	5.17%	5.93%
Divorced / Separated	24.11%	16.95%	19.02%
Never married	11.35%	4.60%	6.54%

Table 1: Characteristics of the 2011-2012 NHANES respondents (veterans) – results from two-step clustering.

Variables	Segment 1 (N=1,054)	Segment2 (N=2,097)	All (N=3,151)
# drinks per day	3.56 (3.62)	2.88 (2.59)	3.11 (2.99)
Age	41.22 (14.98)	46.49 (16.67)	44.73 (16.31)
Have little interest in doing things			
Not at all	31.78%	95.18%	73.98%
Several days	46.58%	4.29%	18.44%
More than half the days	12.05%	0.43%	4.32%
Nearly everyday	9.58%	0.10%	3.27%
Feeling down, depressed, or hopeless			
Not at all	28.46%	96.42%	73.69%
Several days	49.15%	3.29%	18.63%
More than half the days	11.57%	0.19%	4.00%
Nearly everyday	10.82%	0.10%	3.68%
Trouble sleeping or sleeping too much			
Not at all	26.47%	74.68%	58.55%
Several days	35.86%	19.84%	25.20%
More than half the days	16.22%	2.24%	6.92%
Nearly everyday	21.44%	3.24%	9.33%
Feeling tired or having little energy			
Not at all	14.33%	67.19%	49.51%
Several days	46.58%	29.14%	34.97%
More than half the days	18.60%	2.05%	7.58%
Nearly everyday	20.49%	1.62%	7.93%
Poor appetite or overeating			
Not at all	40.42%	88.75%	72.58%
Several days	34.35%	10.11%	18.22%
More than half the days	13.00%	0.81%	4.89%
Nearly everyday	12.24%	0.33%	4.32%
Feeling bad about yourself			
Not at all	47.53%	97.23%	80.61%
Several days	36.24%	2.67%	13.90%
More than half the days	8.44%	0.05%	2.86%
Nearly everyday	7.78%	0.05%	2.63%
Trouble concentrating on things			
Not at all	52.66%	95.90%	81.43%
Several days	29.51%	3.43%	12.15%
More than half the days	8.73%	0.29%	3.11%
Nearly everyday	9.11%	0.38%	3.30%
Variables	Segment 1 (N=1,054)	Segment 2 (N=2,097)	All (N=3,151)
Thought you would be better off dead			
Not at all	90.51%	99.86%	96.73%
Several days	7.12%	0.14%	2.48%
More than half the days	1.14%	0.00%	0.38%
Nearly everyday	1.23%	0.00%	0.41%
Sex			
Male	41.08%	51.50%	48.02%
Female	58.92%	48.50%	51.98%
Race/Ethnicity			
Non-Hispanic White	44.31%	52.98%	50.08%
Non-Hispanic Black	17.65%	15.55%	16.25%
Hispanic	31.88%	27.32%	28.85%
Other	6.17%	4.15%	4.82%
Marital Status			
Married / Living with partner	48.20%	64.90%	59.31%
Widowed	5.12%	5.05%	5.08%
Divorced / Separated	18.50%	12.35%	14.41%
Never married	28.18%	17.69%	21.20%

Table 2: Characteristics of the 2011-2012 NHANES respondents (non-veterans) – results from two-step clustering.

non-veterans, the percentages individuals who are either married or living with a partner are relatively higher in this cluster.

Conclusion

Findings suggest that alcohol use and depression co-occur more commonly than expected and both self-medication and intoxication processes may be at work. Therefore, the differential diagnosis between alcohol-induced anxiety disorders and comorbid depressive disorders can be difficult [15]. Findings from the cluster analysis suggest that individuals with more frequent manifestation of depressive symptoms tend to consume more alcohol. On one hand, findings may be attributable to the temporary sedative and mood altering effects of alcohol and some individuals may drink temporally alleviate aversive depressive symptoms such as anxiety, depression, and other forms of psychological distress. On the other hand, it is also logical to assume that alcohol consumption contributes to the development and precipitation of depression. This implies that depressed individuals are less likely and able to quit drinking due to intoxication. Indeed, an earlier study reveals that the prevalence of alcohol use is quite high (at least 90 percent) in most Western countries and more than 30 percent of these drinkers develop alcohol-related life problems later on [38]. About 10 percent of men and three to five percent of women develop severe alcohol-related life impairment at some point during their lives [38]. Thus, surveillance of depression is a necessary first step toward alcohol abuse prevention and control.

Another important finding is that marriage has protective effects on alcohol use and depression for both veterans and non-veterans. A somewhat higher percentage of individuals in the second segment are married and individuals in this segment tend to consume less alcohol on a daily basis and have less frequent manifestation of depressive symptoms. In contrast, the first segment consists of a slightly higher percentage of divorce/separated as well as a somewhat higher percentage of unmarried individuals. Individuals in this segment tend to consume more alcohol on a daily basis. Researchers have acknowledged the potential protective mechanism of marriage as early as the early 1990s [31]. According to them, marriage is not only a resource for social and emotional support but also confers other financial, legal, and material advantages [31]. As such, being married is a way of reducing the risk of substance abuse and gaining increased protection against adverse mental health outcomes. A related finding also revealed that spouses, especially wives, tend to play a greater role in the social control of health behaviors and maintaining contact with friends and family [32]. Thus, it is possible that individuals who remained divorce or separation experienced strains associated with household management and changes in the patterns of kin network and social support. Thus, special attention with regard to prevention, treatment, and policy should be given to never married or previously married individuals.

In the past, mental health disorders and addiction problems were often treated separately. Just treating alcohol use disorder will not cause depression to automatically improve and vice versa. To mitigate the negative consequences of alcohol use and depression, there remains a pressing need for an integrated treatment of both alcohol use and depression that simultaneously treat these two disorders. The best option for the treatment of comorbid patients might be standard treatment for substance use plus cognitive–behavioral therapy [1]. This is essential for the proper treatment of alcohol dependence [39]. Nevertheless, an integrated treatment can be a challenging endeavor because depression and alcoholism may be seen as stigmatizing [2] and respondents may underreport or not disclose their alcohol use. Even

though the prevalence of post-combat mental health problems is high, only half of the soldiers seek care within a year of deployment [40,41]. This is due mainly to stigma and perceived barriers to care such as such as lack of time and transportation problems [42,43].

Findings suggest that cluster analysis provides an innovative approach to identify the presence of individuals who are at risk of alcohol use and depression. The findings demonstrate that individuals can have very different patterns of alcohol use and depressive symptoms. The cluster profiles can serve to guide the development of a tailored intervention program. Successful prevention and intervention programs will necessitate interventions that target respondents with high levels of depression and alcohol use. Thus, health policymakers and practitioners should try to meet the needs and expectations of the different segments of population by tailoring and customizing healthcare policies according to their preferences and patterns of usage.

Since becoming addicted to drinking is a process which proceeds through various stages of drinking initiation and adaptation, alcohol use control policies that inform people about the health risks of alcohol abuse should begin at an early age. Progress can be made towards reducing the negative consequences associated with alcohol consumption by changing behaviors at an early age. School children should be educated about how risky drinking behaviors can jeopardize their health in terms of the side effects, symptoms, and other warning signs.

Limitations

Interpretation of these results, however, should also consider the limitations of the study. First, the 2011-2012 NHANES, however, does not provide information on marital quality (e.g. happiness, satisfaction, sharing of activities, conflict, communication, etc.), family support (e.g. tangible help, emotional attachment, etc.), age of drinking onset, the duration of alcohol consumption, and personality traits. Once more recent, detailed and sufficient data become available, one of the important tasks for future research is to examine the interplay between marital quality, family support, personality traits, and subsequent alcohol consumption and depression.

Second, the 2011-2012 NHANES does not provide information on clinically diagnose depression. As alluded in the Data section, depression symptoms are assessed a list of survey questions. The scoring system of these questions can only be used as an indicator of symptoms relating to depression but not to clinically diagnose depression. Higher scores may indicate that further clinical tests/screenings are warranted, and lower scores do not suggest the absence of clinical depression.

Despite the limitations of the data, this study is a step towards describing and identifying the interplay of alcohol use, depression, and veteran status. This is more essential than ever, as alcohol abuse among military personnel remains an important issue because it not only affects military readiness and productivity but it can also lead to other adverse health-and work-related consequences [33,36,44-48]. Specifically, excessive drinking within the military is estimated to result in a loss of 320,000 work days, 34,400 arrests per year, 10,400 active members unable to be deployed, and 2,200 separations [49]. In addition, excessive alcohol consumption has cost the U.S. military $1.12 billion per year [50].

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