

MORNING DRINKING MEDIATION BETWEEN INSOMNIA AND DEPRESSION
WITHIN INDIVIDUALS WHO DRINK: A MEDIATION ANALYSIS THROUGH
THE FIRST YEAR OF THE COVID-19 PANDEMIC

By

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A Thesis Submitted to The W.A. Franke Honors College

In Partial Fulfillment of the Bachelor Degree
With Honors in

Molecular and Cellular Biology

THE UNIVERSITY OF ARIZONA

M A Y 2 0 2 3

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1. Abstract

During the COVID-19 pandemic, many individuals increased their alcohol consumption to cope with stress. Excessive intake or drinking at inappropriate times can be important features of hazardous alcohol use. It is also known that alcohol can impair quality sleep. However, a potential relationship between aspects of hazardous alcohol use and insomnia during the pandemic has not been investigated. We hypothesized that there would be a significant correlation between morning drinking and insomnia. However, we also hypothesized that this relationship would be mediated by depression. A total of 13,313 individuals across the United States were surveyed ($M=37.19$ years old; $SD \pm 12.375$). The online survey included self-report measures of depression, insomnia symptoms, and alcohol use. For this study, participants were asked specifically about their frequency of taking a drink first thing in the morning, which was assessed with an item from the Alcohol Use Disorders Identification Test (AUDIT). Insomnia was measured with the Insomnia Severity Index (ISI). Participants also completed the PHQ-9 Depression Scale. Morning drinking scores correlated with insomnia ($r=.254$, $p<.001$) and depression ($r=.344$, $p<.001$). A mediation model revealed a total effect of insomnia on morning drinking when depression was not accounted for ($E=.0303$, $p<.0001$). After including PHQ-9 Depression as a mediator, the direct effect was still significant ($E=.0032$, $p=.0406$), suggesting partial mediation. On the other hand, when insomnia was the mediator variable, the total effect and direct effect had no significant change (“total effect” $E=.0414$ $p<.0001$) (“direct effect” $E=.0391$ $p<.0001$), suggesting no mediating influence. These results suggest that the association between morning drinking and insomnia was partially mediated by depression during the pandemic. When depression was the independent variable and insomnia was the mediated variable, there was no longer efficiency in the mediation model. These results suggest that

observed associations between insomnia and morning drinking during the pandemic were partially mediated by depression.

2. Introduction

The COVID-19 pandemic constructed a world of unpredictable cultural and commercial stressors to growing connectivity and proliferating society. Forced quarantines, exile of social interaction, and prolonged social isolation promoted additional stressors to the Corona Virus (SARS-V2). Studies were conducted to evaluate the stressors throughout the pandemic to portray the current impacts of the virus. Under situations of depression, loneliness, and extensive social isolation, individuals rely on increased consumption of alcohol to deal with chronic stressors or uncertainty of the present (1). A potential relationship between the aspects of heavy drinking and insomnia during the pandemic has not been fully analyzed. One of the factors that contributed increased alcohol usage was that the pandemic extended into the fall season, which led to an increase in consumption during the summer months (2). Throughout these summer months, individual lockdown status was associated with increased alcohol consumption. Specifically, the mean score of the Alcohol Use Disorders Identification Test (AUDIT) showed an increase of 25.32 percent average score per month for individuals who reported restrictions on lockdown compared to an increase of 1.74 for those without restrictions (3). This increase in alcohol consumption during the pandemic could have long term health implications. People who engage in frequent drinking are at increased risk of chronic health problems such as heart disease, stroke, high-blood pressure, and digestive issues (4).

Importantly, hazardous alcohol use can involve a number of factors, including the amount of alcohol consumed, the frequency, and the timing of its use. For the analysis of the present study, the aspect of drinking that will be addressed will be morning drinking. Prior studies conducted during the pandemic demonstrated that individuals who maintained a job throughout the lockdown reported higher rates of drinking in the morning between the months of April and

September 2020 (5). Morning drinking has been linked to increased dependence on alcohol, greater withdrawal symptoms, more sustained drinking throughout the day, higher number of accidents, reduced productivity, and less likelihood to take care of responsibilities (6).

Additionally, morning drinks are likely to be consumed on an empty stomach, which can increase the likelihood of alcoholic dementia and liver disease (6).

Another critical aspect of health that was affected during the pandemic was sleep (7).

Prior to the pandemic, an increasing body of research demonstrated the importance of sleep on the health of the mind and body. In the United States, studies have found that between thirty and forty percent of adults have symptoms related to insomnia (8). Some symptoms of insomnia may include waking up during the night, daytime sleepiness or tiredness, and difficulty falling asleep during nighttime (9). Chronic insomnia has been estimated in about ten percent of the population with people having difficulty sleeping or daytime symptoms more than three days a week for an extended amount of time (10). Short-term insomnia includes the same symptoms as chronic insomnia; however, the condition will only last up to three months and is caused by external factors, such as life stressors. Fifteen to twenty percent of adults per year report rates of short-term insomnia. Due to the pandemic, social and economic conditions introduced additional stressors that may contribute to variations in insomnia levels. A study of thirteen countries found that clinical insomnia symptoms rose to 36.7 percent of participants and participants that met criteria for probable insomnia disorder was 17.4 percent (11). Furthermore, populations who had an active infection of COVID-19 had a greater demonstration of insomnia symptoms in general due to stressors of the virus and these symptoms were maintained during their recovery long-term (11).

Mental health markers escalated throughout the COVID pandemic with concerns of deteriorating well-being. Reports of depression and anxiety with increasing uncertainty and worry about the virus were often reported during the pandemic (12). One of the key factors of depression and anxiety has been associated with insomnia with the impact on quality of life, suicide rates, and alterations in mood (13). During the lockdowns of the COVID-19 pandemic, the total population saw an increase in alcohol use and depression due to long durations of social isolation from quarantining (13, 14). Amongst the studies conducted throughout COVID-19, insomnia has been suggested to be an applicable predictor in identifying someone's level of depression (15). The COVID-19 virus was combatted through social distancing and isolation, which may be linked to changes in people's mental health and other well-being issues. Within this current investigation, we sought to evaluate the potential correlation between insomnia and morning drinking throughout the COVID-19 pandemic, as well as how a suggested factor of depression could potentially mediate the effects. We hypothesized that there would be a significant association between morning drinking and insomnia. Additionally, we also hypothesized that this relationship would be mediated by depression.

3. Methods and Participants

3.1 Participants

A total of 13,313 English-speaking individuals ($M=37.19$ years old; $SD \pm 12.375$) between April 2020 and April 2021, completed a monthly, online, cross-sectional mental health assessment survey throughout the United States with around 1,000 participants per month (Table 1). A summary of the number of participants surveyed during each month of data collection is referenced in Table 2. Additionally, for the specific demographic distribution of participants reference Table 1. Participants from all fifty states and the District of Columbia (42.0% male, 57.5% female, 0.5% other or declined to answer, Table 3) were asked to complete an online survey through the Amazon Mechanical Turk (MTurk) crowdsourcing platform. Individuals were recruited through the MTurk platform and then sent an email message regarding eligibility rules for participation in a COVID-19-related survey. Individuals were eligible for full enrollment in the study if they were able to pass an English reading comprehension screener indicating 6th-grade English literacy or better. Along with reading literacy, eligibility requirements included residence in the United States and an age between 18 and 90 years (Table 4) All fully enrolled participants were provided a description of the study and completed written informed consent. All study procedures were approved by The Institutional Review Board of the University of Arizona. Thirteen independent samples were collected at one-month intervals that began in April 2020 and concluded in April 2021. Participants were administered numerous questionnaires regarding their experience during the COVID-19 pandemic, including the mental health battery relevant to our research inquiry. Participants who had previously participated in an earlier assessment were ineligible for participation in an additional monthly assessment.

Table 1:

Administration	N	Percentage of Total Study Sample
April 2020	1,013	7.60%
May 2020	1,038	7.80%
June 2020	1,070	8.00%
July 2020	1,043	7.80%
August 2020	1,007	7.60%
September 2020	1,019	7.70%
October 2020	1,022	7.70%
November 2020	1,037	7.80%
December 2020	1,035	7.80%
January 2021	1,011	7.60%
February 2021	1,001	7.50%
March 2021	1,008	7.60%
April 2021	1,009	7.60%

Table 2:

Ethnicity	N	Percentage of Total Study Sample
White	9,305	69.90%
Mexican/Mexican American	329	2.50%
Other Hispanic/Latino	316	2.40%
Black/African American	1,165	8.80%
Native American/American Indian/Native Alaskan	117	0.90%
Asian: Chinese	191	1.40%
Asian: Other Non-Chinese	527	4.00 %
Native Hawaiian/Pacific Islander	33	0.20%
Other	250	1.90%
Prefer not to answer	1,080	8.20%

Table 3:

Sex	N	Percentage of Total Study Sample
Male	5,598	42.05%
Female	7,654	57.49%
Prefer Not To Answer	50	00.38%
Did Not Answer	11	00.08%

Table 4:

Age	N	Percentage of Total Study Sample
18-29	3,928	29.50%
30-39	4,743	35.63%
40-49	2,170	16.30%
50-59	1,335	10.03%
60-69	692	05.20%
70-79	209	01.57%
80+	6	00.05%
Did Not Answer	230	01.73%

3.2 Materials and Procedure

The online cross-sectional mental health assessment battery included the Insomnia Severity Index (ISI), Patient Health Questionnaire (PHQ), and the Alcohol Use Disorder Identification Test (AUDIT) to evaluate the frequency and intensity of alcohol use habits (16). These alcohol habits pertained to the frequency of alcohol use in particular situations and in the context of five specific habits. Individuals completed online versions of the ISI and PSQ for each monthly administration.

The Insomnia Severity Index (ISI) is a brief self-report assessment regarding the pervasiveness of insomnia symptoms and is as a reliable indication of the severity of perceived insomnia (17, 18). The ISI analyzes participant responses by the severity of clinical insomnia on a 28-point scale, which their reported symptoms qualify for (0-7 score = no clinical insomnia, 8-14 = subthreshold insomnia, 15-21 = moderate clinical insomnia, and 22-28 = severe clinical insomnia). All levels of insomnia were included within the analysis.

The Patient Health Questionnaire (PHQ) is an examination index which calculates the possibility of depressive disorder (19, 20). The method of evaluation of depression has undergone extensive independent validity studies, contributing to its widespread usage (21, 22). However, for this study, an amalgamated version of the PHQ formally referred to as the PHQ-ADS was utilized. The PHQ-ADS combines the PHQ-9 and the Generalized Anxiety Disorder-7 (GAD-7) self-report survey to screen for major depressive disorder as well as a generalized anxiety disorder (23). For the scoring of this study, the GAD-7 represented the PHQ anxiety subscale score, PHQ the depression subscale, and supplementary alcohol usage questions served as the PHQ alcohol subscale. The PHQ-9 depression scale analyzes participant responses by the severity of clinical depression on a 27-point scale, which their reported symptoms qualify for (0-

4 score = no depression, 5-8 = mild depression, 10-14 = moderate depression, 15-19 = moderately severe depression, 20-27 severe depression). All levels of depression were included within the analysis.

The frequency and intensity of alcohol use habits questions were the self-admitting questions about alcohol use over time from the AUDIT. Participants who self-admitted to drinking alcohol were used for analysis of this study (Table 5). The content included five specific drinking habits on the frequency of alcohol use in particular situations. The variable description for this analysis was “How often during the last year have you needed a first drink in the morning to get yourself going after heavy drinking?” The scoring was based on a five-point scale ((0) never (1) less than monthly (2) monthly (3) weekly (4) daily or almost daily).

Analyses of results were primarily computed with the use of IBM’s Statistical Product and Service Solutions (SPSS) including computation of standard errors, generating of figures, linear modeling, and significance tests. A listwise exclusion case was completed for the PHQ-9 depression, ISI, and AUDIT questionnaire in which if participants did not fulfill all questions, the participant was excluded from the analysis. Additionally, the logistic regression path analysis and observed variable OLS of PROCESS for SPSS by Andrew F. Hayes were used for the Mediation Analysis.

Table 5:

Administration	Number of Individuals Self-Admit to Drinking	Percentage of Sample Self-Admit to Drinking
April 2020	742	7.49%
May 2020	801	8.09%
June 2020	816	8.24%
July 2020	799	8.07%
August 2020	771	7.79%
September 2020	782	7.90%
October 2020	764	7.71%
November 2020	757	7.66%
December 2020	778	7.87%
January 2021	712	7.19%
February 2021	736	7.43%
March 2021	726	7.33%
April 2021	715	7.17%
Total	9899	100%

4. Results

4.1 Interactions between Insomnia, Depression, and Morning Drinking with Self-Admitted Alcohol Consumption

The analysis included all values of PHQ and ISI, however only participants who admitted to drinking were included. A linear regression analysis demonstrated a significant association between insomnia and morning drinking ($R = .218$, $t = 25.776$, $p < .001$). Additional linear regression analyses also demonstrated a significant association between depression (PHQ-9 Depression questionnaire) and morning drinking ($R = .296$, $t = 35.701$, $p < .001$). During second level analyses, participants who admitted to drinking only were included. Our results demonstrated a significant association between insomnia and morning drinking ($R = .254$, $t = 26.129$, $p < .001$) over the time of administration for people that admitted to drinking. A similar significant association was found and demonstrated a significant association between depression and morning drinking ($R = .344$, $t = 36.414$, $p < .001$). Linear regression analysis demonstrated a significant association between insomnia and depression among self-reported drinkers ($R = .699$, $p = .0000$, $t = 97.250$). The values of each variable within the drinking population were plotted by month of administration during the pandemic, starting in April, 2020 (i.e., “admin” in the figures) (Figures 1, 2, and 3). Based on the data analyzed and similarities in depression, insomnia, and morning drinking, we hypothesized that the correlation between insomnia and morning drinking would no longer be significant when a mediator variable of depression was accounted for.

Figure 1:

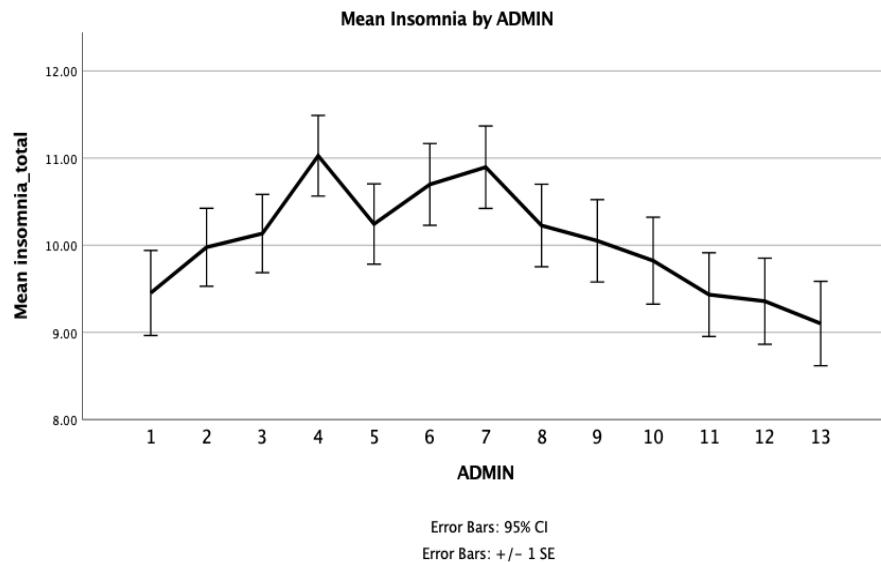


Figure 1: Average total ISI score over each month of administration.

Figure 2:

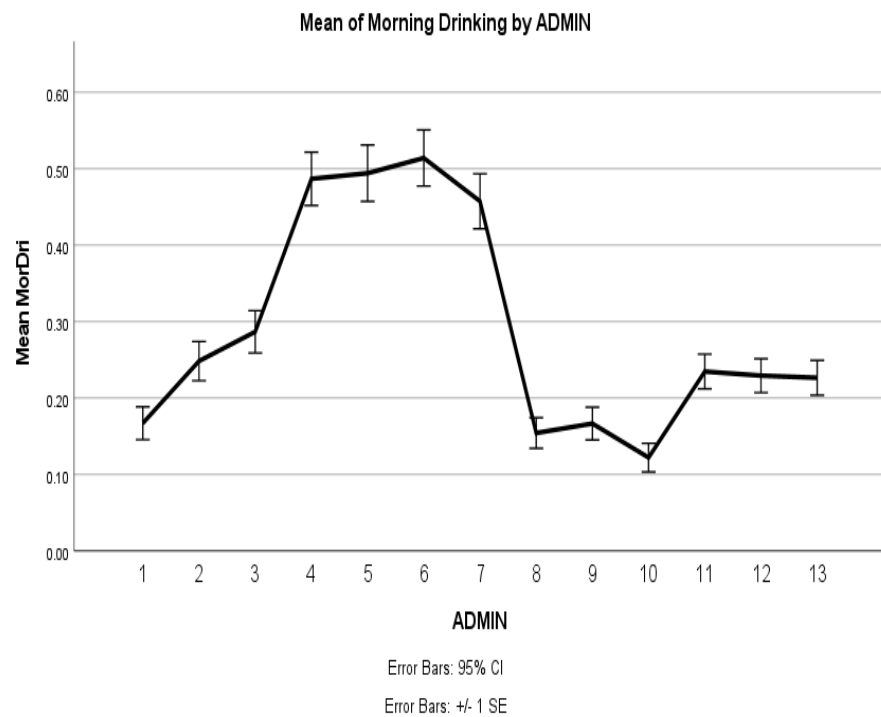
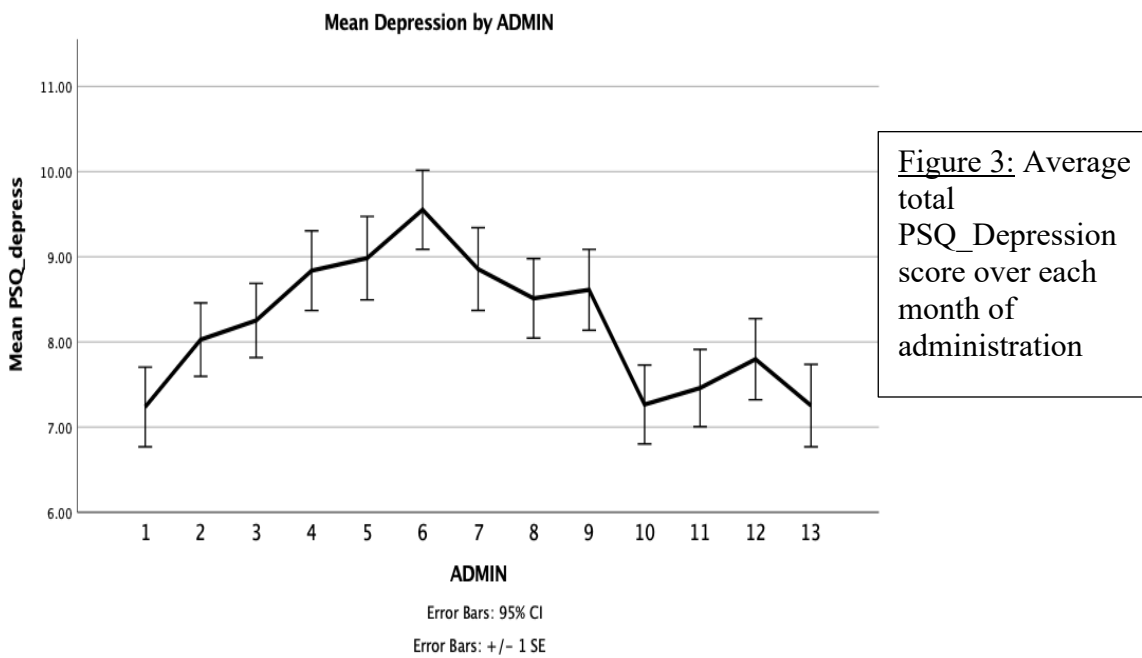


Figure 2: Average total Morning Drinking score over each month of administration.

Figure 3:



4.2 Mediation Analysis between Insomnia and Morning Drinking Mediated by Depression

Based on these associations, a simple mediation model was completed to represent a mediator variable through an independent and dependent variable correlation. The model consists of two antecedent variables, and two consequent variables, with variable X prompting variables M and Y, and variable M manipulating variable Y (24). The model portrays two pathways, in which the direct effect is X on Y without M, and the indirect effect is X on Y through M (24).

An initial simple mediation model was used to evaluate the hypothesis of insomnia conveying its effect on morning drinking. The model consisted of insomnia indicating depression and morning drinking, and depression manipulating morning drinking. The mediation model revealed a total effect of insomnia on morning drinking when the depression was not accounted for ($E=.0303$, $p<.0001$). After including PHQ-9 Depression as a mediator, the direct effect was still significant ($E=.0032$, $p=.0406$), suggesting partial mediation (Figure 4). On the other hand, when insomnia was the mediator variable, the total effect and direct effect had no significant change (“total effect” $E=.0414$ $p<.000$; “direct effect” $E=.0391$ $p<.0001$), suggesting no mediating influence (Figure 5). The data suggests that the relationship between insomnia and morning drinking is significantly mediated by depression.

Figure 4:

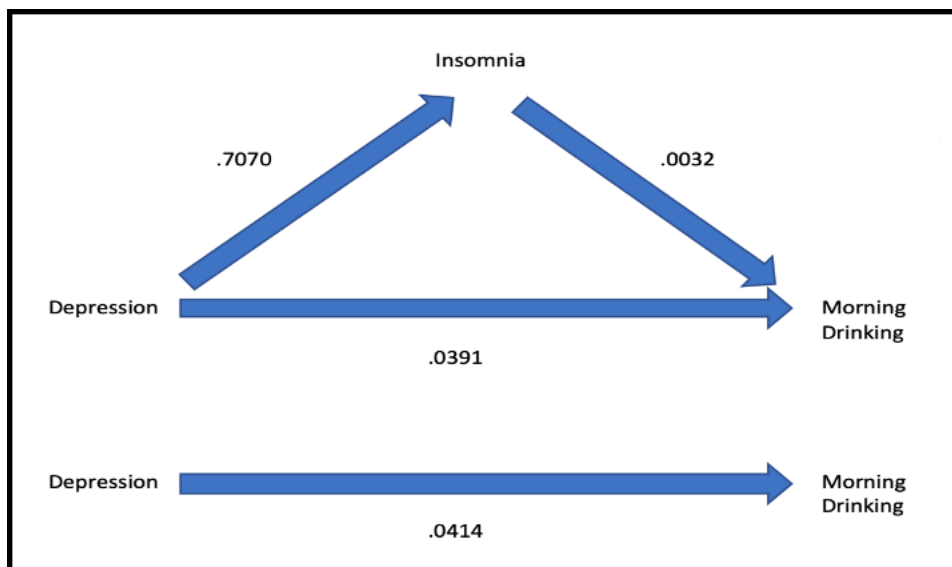
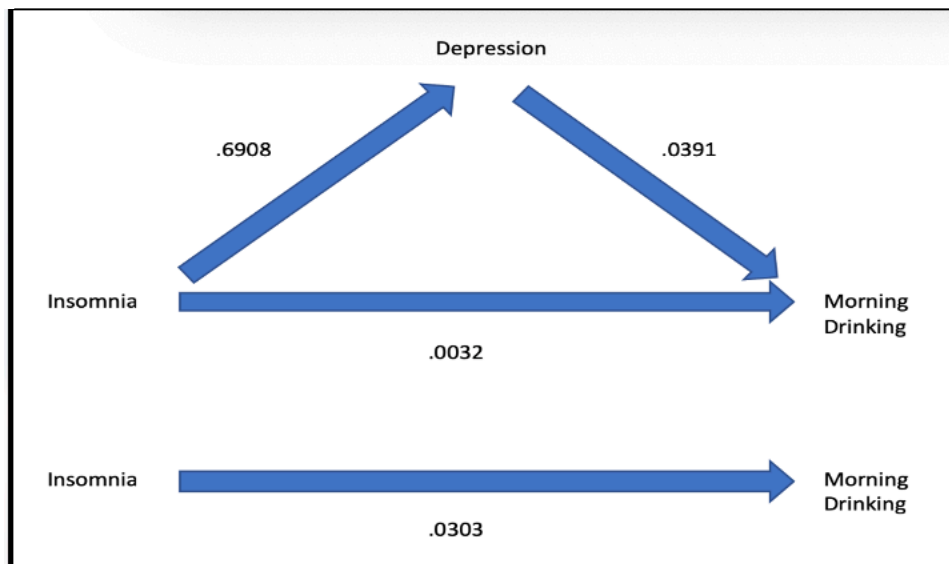


Figure 5:



5. Discussion

This study suggests the association between insomnia and drinking in the morning after a night of drinking, is mediated by depression, within a population of people who drank throughout the COVID-19 pandemic. These findings suggest that insomnia could have a greater effect on alcoholism than previously established, but that this effect is partially mediated by an individual's level of depressive mood. A regular occurrence of drinking in the morning or being dependent on alcohol in the morning can be an initial sign of alcoholism or alcohol abuse (25). These results offer ideas that facilitating people with their sleep or treatment for insomnia can assist people in improving their depression levels leading to variations in engaging in morning drinking. However, these findings do suggest that insomnia is not the mediator for depression and morning drinking. The lack of a significant indirect effect of the mediation by insomnia hints at the prevalence of insomnia and the importance of sleep on one's emotions and actions. The strength of the simple mediation analysis is the ability to have insight in a correlation and conclude the true cause of the linkage. However, the limitation of the analysis is it cannot represent all possible mediators, but only one at a time.

Throughout the time of the pandemic, thoughts of uncertainty and social isolation contributed to increased depression (12). A suggestion that may be used to counteract the increase in depression during this time would be to have people use cognitive behavioral therapy to help people with their insomnia. These proposals could help the prevalence of alcoholism and day drinking throughout the population. During the first year of the COVID pandemic, the sales of alcohol increased by 2.9 percent from the previous year, which marks the highest annual increase in sales over the last 50 years (26). One of the major issues with the increase in sales was the increase in deaths involving alcohol. Before the pandemic occurred, the annual change in

deaths due to alcohol was growing at 2.2 percent per year. However, during the first year of the pandemic, the rate of deaths caused by alcohol increased by 25 percent (27). These increases in deaths and dependency on alcohol indicate the importance of assisting people with their alcohol control.

In 2019, the National Survey on Drug Use and Health reported that 85.6 percent of people over the age of 18 have consumed alcohol at some point in their life. Furthermore, in the same report, the number of people 18 years or older who engaged in binge drinking or heavy alcohol usage was reported at 25.8 percent (28). With these high values of signs of alcoholism, there have been multiple attempts to aid people in their efforts to fight it. The Mayo Clinic lists multiple treatment plans to help with alcohol use disorder. These treatments include psychological counseling, for reaching out to support groups to understand the problems and how to recover, helping with psychological problems, for people having issues with depression, anxiety, and many others, and medication, such as naltrexone to block the positive feelings of alcohol (29). However, there is not much mention of the possibility of sleep helping with reducing alcohol use disorders.

Some studies have suggested the idea that sleep problems can lead people to alcoholism. An initial study during the Epidemiological Catchment Area surgery found that people who had events of persistent insomnia were 2.4 times more likely to indicate alcohol abuse than adults who did not report any (30). However, one of the flaws of the study was there was no exclusion of people who had other psychiatric disorders that possibly would influence the dataset. To further validate the findings of the previous study, another investigation specifically excluded people with psychiatric disorders before the completion of the survey. The investigators found that there was an increased ratio of 2.3 for people with insomnia to develop alcohol abuse than

people without insomnia (31). Nevertheless, people often use alcohol to aid in their sleep problems. Studies have reported that 6 to 19 percent of the general population and 15 to 28 percent of people who have reports of insomnia have or currently use alcohol as a method to facilitate sleep onset (32,33). Additionally, the issue only increases as the number of alcoholic drinks consumed increases. Among alcoholics who have entered treatment for alcohol abuse one study reported that between 44 and 60 percent of them have used alcohol to aid them in falling asleep (32). Consequently, these findings may indicate an emphasis on treating people for their sleep issues. It is reported that around one-third of the population experiences insomnia and up to ten percent have chronic insomnia (34). Being able to aid in people getting a full night's rest and allowing time for the mind and body to heal may lead to other improvements mentally and physically. Further research could be used to evaluate other possible mediators that could influence the correlation between depression and morning drinking.

Limitations of this study included the inability to confirm the reliability of the survey responses. The participants completed the questionnaires over the internet while not being supervised. Hence, the reliability of the data collected may be of concern. Additionally, there are limitations to only using correlation data. There is no determinate causation within using correlation data. Furthermore, there is the possibility of confounding factors that may influence the results that may have been unnoticed.

6. Conclusion

The discovery within this study suggests that there is a mediator of depression represented within the total effect of insomnia on morning drinks. These results suggest that the association between morning drinking and insomnia was partially mediated by depression during the pandemic. When depression was the independent variable and insomnia was the mediator variable, there was no longer efficiency in the mediation model. These results suggest that observed associations between insomnia and morning drinking during the pandemic were partially mediated by depression. Our findings may provide an understanding of how the COVID-19 pandemic has affected alcohol use patterns throughout the United States.

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