Alcohol use, sleep, and depression among family caregivers in the time of COVID-19

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ABSTRACT

The COVID-19 pandemic has substantially altered daily life around the world, resulting in significant impacts on health behaviors. The additional burdens imposed by family caregiving (i.e., providing unpaid care for children and/or adults) may further exacerbate negative effects of the pandemic on health and health behaviors, including increased alcohol consumption, poor sleep, and increased depressive symptoms. The current study examined this possibility. Participants (N = 320, mean age = 35.11 years) completed an online questionnaire assessing alcohol use, sleep, and depression during the COVID-19 pandemic (June–August 2020) and retrospectively assessed the same health behaviors in the months prior to the pandemic. Insomnia severity increased, sleep quality decreased, and depressive symptoms increased for both caregivers and non-caregivers during the pandemic ($p < 0.001$). By contrast, alcohol consumption increased among caregivers only ($p < 0.05$). Further, increased alcohol use was associated with decreased sleep quality and increased insomnia symptoms among caregivers, but not non-caregivers. While additional longitudinal research is warranted in this population, our findings offer important insight on self-reported changes in alcohol consumption, sleep patterns, and mood among family caregivers during the COVID-19 pandemic.

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Introduction

The COVID-19 pandemic is deeply impacting social structures and behavioral patterns across the globe. National lockdowns, social distancing, and quarantines have disrupted nearly every aspect of daily function. Abrupt changes and substantial restrictions placed on individuals' routines could have considerable negative influences on health and health behaviors, including alcohol use, sleep, and depression (Anthenelli, 2012; Anthenelli & Grandison, 2012; Grandner, 2019; Moloney, 2017). Importantly, there is a bidirectional relationship between sleep and alcohol use; alcohol use impairs sleep and impaired sleep may be associated with drinking as a means to fall asleep (Koob & Colrain, 2020). Further, both sleep and alcohol use are closely linked to symptoms of depression (Boden & Fergusson, 2011; McHugh & Weiss, 2019; Zhai, Zhang, & Zhang, 2015). As such, pandemic-induced disruptions in any of these areas could lead to associated disruptions in

others. One subgroup of the population that may be particularly vulnerable to negative consequences are family caregivers, as these individuals have faced the added responsibility of providing unpaid care for children and/or adults during the pandemic. We examined relationships between changes in alcohol use, sleep, and depression during the pandemic in caregivers and non-caregivers.

There is substantial evidence showing that sleep problems increased over the first year of COVID-19. A meta-analysis of 44 peer-reviewed articles published between November 2019 and July 2020 investigating the effect of COVID on duration and quality of sleep found that sleep problems impacted 40% of the general global population during the pandemic (Jahrami et al., 2021). A second meta-analysis (Alimoradi et al., 2021) included 177 peer-reviewed articles published between December 2019 and February 2021 (161 new articles and 16 articles that overlapped with Jahrami et al., 2021). Similar to results reported by Jahrami et al. (2021), findings showed that 37% of the global population experienced sleep problems during the pandemic.

The pandemic also impacted alcohol consumption. Numerous nations, including China, Russia, Israel, Czechia, Canada, Australia, and the United States reported increased alcohol use (Striley &

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Hoeflich, 2021; Tran, Hammarberg, Kirkman, Nguyen, & Fisher, 2020). Grossman and colleagues (Grossman, Benjamin-Neelon, & Sonnenschein, 2020) found that two-thirds of individuals in the United States reported that their drinking increased compared to pre-COVID-19, largely due to boredom, increased stress, and increased alcohol availability. Another study reported that 14% of adults in a U.S. sample reported increased alcohol use during COVID-19 (Avery, Tsang, Seto, & Duncan, 2020).

Emerging evidence also suggests that COVID-19 has impacted depression. A systematic review found that 21.4% of individuals sampled in multinational studies met criteria for clinically significant depression during the pandemic (Lee et al., 2021). Increased depression levels during the initial wave of COVID-19 have been reported in Germany, Spain, Greece, and the United Kingdom (Bäuerle et al., 2020; Fancourt, Steptoe, & Bu, 2021; Fountoulakis et al., 2021; González-Sanguino et al., 2020). This aligns with research showing a general increase in depressive symptoms among North American adults (Zheng et al., 2021). Additionally, younger adults and females have tended to report more depressive symptoms during the COVID-19 pandemic compared to older adults and males (Bäuerle et al., 2020; González-Sanguino et al., 2020; Shah, Mohammad, Qureshi, Abbas, & Aleem, 2021); importantly, these groups may be more likely to be caregivers.

Four initial studies have reported on the relationship between increased alcohol use, impaired sleep, and/or increased depressive symptoms during COVID. One Canadian study found worsening of and new onset sleep difficulties were related to elevated alcohol consumption (defined as having more than seven drinks per week; Robillard et al., 2021). Additionally, in a Brazilian sample, increased alcohol use during the pandemic was associated with nightmares during the pandemic (Musse et al., 2020). Another Canadian study found that higher depression scores predicted past 30-day alcohol use and drinking to cope (Wardell et al., 2020). Finally, one study from the U.S. showed that moderate to severe depression was related to both increased alcohol use and worsening sleep quality during COVID-19 stay-at-home orders (Knell, Robertson, Dooley, Burforf, & Mendez, 2020). These findings provide preliminary support for an association between increased alcohol consumption, impaired sleep, and heightened depressive symptoms during the pandemic.

It is important to note that poor sleep and alcohol use did not increase universally during COVID. In a Canadian sample, a small minority of participants (6%) reported *improved* sleep quality during the pandemic (Robillard et al., 2021). Heavy drinking *decreased* among emerging young adults ages 19—23 in Canada (Minhas et al., 2021) and young adults ages 18—25 in Australia (Callinan et al., 2021), potentially due to the closure of bars. Additionally, *decreased* alcohol consumption during the pandemic was reported by 12.8% of a U.S.-based sample (Grossman et al., 2020) and 21.1% of drinkers in a French sample (Constant, Conserve, Gallopel-Morvan, & Raude, 2020). In sum, while poor sleep and alcohol use increased for many people worldwide, these trends are not universal and warrant further investigation to determine which populations are at greatest — or least — risk of experiencing negative pandemic-related effects on sleep and alcohol use.

Family caregivers are a subgroup that may be more vulnerable to increased alcohol consumption, disrupted sleep, and increased depressive symptoms during the pandemic. Many caregivers experienced the added challenge of providing for family members in uncertain economic times, as well as providing care around the clock due to the closure of schools and daycares. Prior to COVID-19, studies found associations between family caregiving and poor sleep, increased alcohol use, and depressed mood (Byun, Lerdal, Gay, & Lee, 2016; Collins & Kishita, 2020; Evenson & Simon, 2005; Rospenda, Minich, Milner, & Richman, 2010; Umberson,

Pudrovska, & Reczek, 2010). In line with this, new COVID-19 research from the United Kingdom showed increased alcohol use among those living with children (Ingram, Maciejewski, & Hand, 2020), and findings from Canada showed that those living with children were more likely to drink to cope (Wardell et al., 2020). Additionally, a U.S. study of university students showed that caregiving during the pandemic, specifically for individuals experiencing illness as a result of COVID-19, was associated with greater likelihood of alcohol use (Oh et al., 2021). A separate, longitudinal Canadian study found that mothers had significant increases in depressive symptoms during the pandemic (Racine et al., 2021). Similarly, a systematic review found that 27.4% of caregivers developed depression while isolating with their children during the pandemic (Panda et al., 2021). Caregivers have also reported higher depression scores during the COVID-19 pandemic compared to non-caregivers in the United Kingdom (Gallagher & Wetherell, 2020). However, less is known about family caregivers' sleep during COVID-19 or the degree to which increased alcohol consumption during the pandemic was associated with impaired sleep or depressed mood.

To address these gaps in the literature, the current study examined how the COVID-19 pandemic impacted self-reported sleep, drinking, and mood among family caregivers and non-caregivers in the United States during the summer of 2020. We hypothesized that caregivers would report an increase in alcohol use, sleep problems, and depression symptoms during COVID-19 compared to non-caregivers, and that changes in each of these measures would be related.

Method

Study design

This study used both present and retrospective self-reports to assess community-level changes in alcohol use, sleep, and depression during the COVID-19 pandemic. A convenience sample of adults ages 21 years and older with Internet access and English-language fluency was eligible to participate in the study. All participants provided informed consent. Participants reported their drinking, sleep, and depressive symptoms in the months before the COVID-19 pandemic began and presently between June and August 2020. Although retrospective report is subject to recall bias, it has been used successfully in previous pandemic-related research (i.e., SARS; Mihashi et al., 2009) and in posttraumatic stress research (Krakow et al., 2000; Port, Engdahl, & Frazier, 2001; Stein et al., 2005).

Participants

Participants were recruited via the University of Kentucky Center for Clinical and Translational Science and social media platforms. Alcohol use was not a requirement for the study. A total of 939 participants opened the survey, and 733 participants completed at least one measure used in this study, resulting in an overall completion rate of 78.1%. The overall response rate could not be determined, as our survey platform did not have the ability to record all interactions (i.e., number of people the survey was sent to and number of people who opened the survey but did not respond). Only participants ages 21—45 and those indicating male or female gender were included in the present analyses, for a final sample size of 320. This age range was selected in order to focus on those who were most likely to be caregivers and to avoid conflation of changing sleep architecture and increased sleep disruption that commonly occurs in older age groups (Taillard, Gronfier, Bioulac, Philip, & Sagaspe, 2021; Vitiello, Larsen, & Moe, 2004).

Individuals who identified as transgender or "prefer not to say" were excluded because their *n* was very small, thus complicating the interpretation of gender as a covariate in analyses. All participants who completed the survey were entered into a raffle to win 1 of 100 $10 Amazon gift cards. The study was conducted in accordance with the Declaration of Helsinki and the protocol was approved by the University of Kentucky Institutional Review Board.

Procedure

The survey was designed and administered via REDCap, a secure, web-based software platform to build, capture, and manage research data (Harris et al., 2019). On average, the survey took participants 25 minutes to complete. After consenting, participants answered questions about demographics and health behaviors. Participants completed well-validated measures assessing alcohol consumption, sleep, and depression.

To enhance validity, our study used the Post-Then-Pre evaluation method (Rockwell & Kohn, 1989), where participants answered each measure about their current status during the pandemic and then retrospectively answered the same measure regarding their pre-pandemic status. Participants were asked to answer each measure "during the last month, during the pandemic" and "during an average month, before the pandemic". The COVID time point reflected behaviors when the participants completed the survey, between June–August 2020. The pre-COVID time point reflected average behaviors in the early months of 2020 before the pandemic began. Prior studies indicate that this method increases response validity and reduces response-shift-bias in self-report because it allows participants to draw on the (more accessible) present moment and familiarize themselves with the measurements (i.e., survey scales) before assessing the (recent) past (Howard & Dailey, 1979; Howard, Milham, Slaten, & O'Donnell, 1981). Importantly, we asked participants to recall their health habits from just a few months ago; some life course studies have asked participants to recall socio-demographic facts from 50 years prior, with good accuracy (Berney & Blane, 1997).

Measures

Alcohol consumption

The Alcohol Use Disorders Identification Test-Consumption (AUDIT-C) was used to assess levels of alcohol consumption (Bush, Kivlahan, McDonell, Fihn, & Bradley, 1998). The AUDIT-C is a screening measure used to identify hazardous drinking by evaluating drinking status, quantity of drinking, and frequency of drinking with three questions scored from 0 to 4. The sum of the three questions creates a total score ranging from 0 to 12. A score of 0 indicates no alcohol use and higher scores indicate more drinking, with scores of 4+ for men and 3+ for women indicating hazardous drinking. Participants answered the AUDIT-C questions about alcohol use both "during COVID-19" and "before COVID-19". An AUDIT-C change score was calculated by subtracting the pre-COVID total score from the COVID total score, such that greater scores indicated greater increase in drinking during COVID.

Sleep quality

Sleep quality was measured with the Pittsburgh Sleep Quality Index (PSQI; Buysse, Reynolds, Monk, Berman, & Kupfer, 1989). Participants answered 10 questions related to sleep "during an average month, before the pandemic" and "during the past month, during the pandemic" in order to assess sleep quality before and during COVID-19. Questions were scored to produce seven subscale scores, each ranging from 0 (no difficulty) to 3 (severe difficulty). The sum of the seven component scores produced the global PSQI

score from 0 to 21, with higher scores indicating worse sleep quality. Global scores of 5+ were indicative of "poor sleep quality". The seven subscales measured subjective sleep quality, sleep latency, sleep duration, sleep efficiency, sleep duration, use of sleep medication, and daytime dysfunction. A PSQI change score was calculated by subtracting the pre-COVID total score from the COVID total score, such that greater scores indicated *worse* sleep quality during COVID.

The wording of Question 4, "during the past month, how many hours of actual sleep did you get at night?" caused confusion for some participants. Answers were meant to be an average of the entire month, however, some interpreted this as the number of hours of total sleep for the past month. A total of 22 participants made this error, either in the pre-COVID question, COVID question, or both. The answers of these 22 participants were manually changed to represent the average amount of sleep in a given night during the past month (e.g., 300 hours of total sleep during the past month was divided by 30 days to produce 10 hours a sleep per night).

Insomnia

Sleep was also assessed with the Insomnia Severity Index (ISI), which measures nocturnal and diurnal symptoms of insomnia (Morin, Belleville, Bélanger, & Ivers, 2011). Participants answered seven questions related to sleep "in an average month before the pandemic" and "in the last month, during the pandemic" in order to assess insomnia before and during COVID-19. Each question is scored from 0 (very satisfied/no sleep problems) to 4 (very dissatisfied/very severe sleep problems). The seven scores were summed to get a total score, ranging from 0 to 28, with higher scores indicating more severe insomnia. The total score can be interpreted with the following categories: 0–7 denotes no clinically significant insomnia, 8–14 denotes subthreshold insomnia, 15–21 denotes moderate clinical insomnia, and 22–28 denotes severe clinical insomnia. An ISI change score was calculated by subtracting the pre-COVID total score from the COVID total score such that greater scores indicated greater increase in insomnia during COVID.

Depression

Depressive symptoms were assessed with the Center for Epidemiologic Studies Depression Scale Revised (CESD-R-10), which is a self–report scale used to measure depression symptoms (Eaton, Smith, Ybarra, Muntaner, & Tien, 2004). Participants answered 10 questions regarding mood "in an average week, before the pandemic" and "during the past week, during the pandemic" in order to assess pre-COVID and COVID depression. Eight questions were scored from 0 (rarely or none of the time) to 3 (all of the time) and two questions were reverse-scored. The sum of all 10 questions produced a total score from 0 to 30, where higher scores indicated more depression symptoms. Scores greater than or equal to 10 suggest clinically significant depression. A CESD-R change score was calculated by subtracting the pre-COVID total score from the COVID total score such that greater scores indicated a greater increase in depression during COVID.

Data analyses

Changes in self-reported alcohol use, sleep quality, insomnia, and depression from pre-to post-COVID were compared between caregivers and non-caregivers using repeated-measures analyses of variance (ANOVA). All analyses included self-reported gender, marital status, and employment status as covariates. Significant interactions were followed by paired samples *t* tests comparing responses pre- and post-COVID separately for caregivers and non-caregivers. To determine the relationships between self-reported

changes in drinking, sleep quality, and insomnia within each group, we created change scores for each measure by subtracting pre-COVID from COVID scores. We then conducted bivariate Pearson correlations separately for caregivers and non-caregivers. Significance levels for all analyses were set at 0.05 with two-sided p values.

Results

Participant characteristics

The sample was composed of 320 adults (282 women; mean age = 35.11 years, SD = 6.71 years). Complete pre-COVID and COVID scores were missing from the following measures: AUDIT-C (n = 85), PSQI (n = 75), ISI (n = 57), and CESD-R (n = 14). One outlier was removed due to AUDIT-C scores greater than three standard deviations above the mean. Demographic data are presented in Table 1. The majority of participants were Caucasian (89.1%), college-educated (83.8%), married or living with a partner (67.8%), and employed full-time (76.3%). Just under half of the sample (46.3%) described themselves as providing unpaid care for children under the age of 18 and/or adults (including adult children, siblings, in-laws, parents, or grandparents). The majority (88%) of caregivers reported caring only for children, while 4.4% cared for only adults and 7.6% cared for both children and adults. Compared to non-caregivers, family caregivers were significantly more likely to be older, $t = 8.91$, $p < 0.001$, married or living with a partner, $\chi^2 = 88.78$, $p < 0.001$, and employed full-time, $\chi^2 = 19.24$, $p = 0.014$. A total of 225 participants (70.03%) reported drinking alcohol in the past year.

Alcohol consumption

Fig. 1 presents mean pre-COVID and COVID AUDIT-C scores separately for caregivers and non-caregivers. The figure shows that mean AUDIT-C scores increased significantly during COVID relative
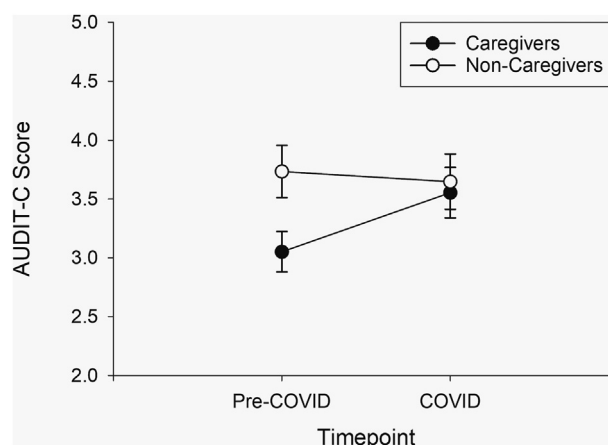
Fig. 1. Alcohol use significantly increased during COVID-19 compared to pre-COVID levels among caregivers (black circles), but not among non-caregivers (white circles). Capped vertical lines indicate standard error of the mean.

to pre-COVID levels in caregivers, but not in non-caregivers. This was confirmed by a significant time × caregiver status interaction [$F(1,226) = 4.90$, $p = 0.028$]. Follow-up paired-samples t tests showed that among caregivers, there was a significant increase in AUDIT-C scores, $t(109) = 3.01$, $p = 0.003$ from pre-COVID to COVID. Among non-caregivers, there was no difference in drinking during COVID compared to before COVID ($p = 0.48$). There was no main effect of time or caregiver status on drinking ($ps > 0.34$). Given that the majority of our sample are women, both pre-COVID and COVID mean scores >3 indicated potentially hazardous drinking.

Sleep

Mean pre-COVID and COVID scores on sleep indices are presented separately for caregivers and non-caregivers in Fig. 2 (PSQI) and Fig. 3 (ISI). Fig. 2 shows that sleep quality, as assessed by the

Table 1
Sample characteristics ($n = 320$).

	Caregivers	Non-caregivers	t/χ^2	p
	(n = 148)	(n = 169)		
Gender (M:F)	13:135	25:144	2.70	0.10
Age (mean [s.d.])	38.32 (5.21)	32.28 (6.65)	8.91	<0.001
Education			6.24	0.39
High school/GED	1	4		
Some college	11	18		
Vocation/Technical/Associate's degree	9	18		
Bachelor's degree	39	54		
Master's/Doctorate/Professional degree	87	85		
Race			8.32	0.22
Caucasian	130	152		
African American	8	4		
Hispanic/Latinx	3	3		
Asian/Pacific Islander	3	5		
Native American	1	0		
Multiracial/other	1	5		
Marital Status			88.78	<0.001
Married/Living with partner	126	90		
Separated/Divorced	10	6		
Widowed	1	0		
Single	9	72		
Employment Status			19.24	0.014
Employed full-time	127	114		
Employed part-time	6	14		
Student	3	17		
Homemaker	1	3		
Self-employed	2	7		
Unemployed	2	5		
Not working due to COVID	6	8		

PSQI, decreased during COVID relative to pre-COVID levels for all subjects (higher PSQI scores indicate higher levels of sleep disturbance). This was confirmed by a significant main effect of time [$F(1,237) = 21.57$, $p = 0.001$]. There was also a significant main effect of caregiver status [$F(1,237) = 4.82$, $p = 0.029$], such that caregivers reported, on average, worse sleep quality than non-caregivers. There was no interaction between time and caregiver status ($p = 0.71$). For both groups, during-COVID, PSQI scores were ≥ 5, indicating poor sleep quality. Fig. 3 shows that insomnia severity, as assessed by the ISI, increased during COVID relative to before COVID levels for all subjects. This was confirmed by a significant main effect of time [$F(1,254) = 8.82$, $p < 0.001$]. There was no main effect of caregiver status ($p = 0.24$) or interaction between time and caregiver status ($p = 0.58$) on insomnia severity. For both groups, ISI scores indicated no clinically significant insomnia pre-COVID; during COVID, scores increased to the level of subthreshold insomnia (>7) for both groups.

Depression

Fig. 4 presents mean pre-COVID and COVID CESD-R scores separately for caregivers and non-caregivers. The figure shows that depressive symptoms increased during COVID relative to pre-COVID levels for all subjects [main effect of time: $F(1,294) = 15.36$, $p < 0.001$]. There was no main effect of caregiver status on depressive symptoms ($p = 0.38$) or interaction between time and caregiver status ($p = 0.85$). During COVID, mean CESD-R scores for caregivers and non-caregivers were above 10, indicating clinically significant depression.

Relationships between changes in alcohol consumption, sleep, and depression

Table 2 presents the bivariate correlations between changes in alcohol consumption, sleep, and depression, separately for caregivers and non-caregivers. The table shows that changes in alcohol consumption were significantly and positively associated with changes in sleep quality and insomnia for caregivers: as drinking increased during COVID-19, sleep quality also became significantly worse and insomnia symptoms increased. By contrast, no association was found for non-caregivers. Changes in depression were not associated with changes in drinking for either group ($ps > 0.05$). However, increases in depression were associated with decreases in
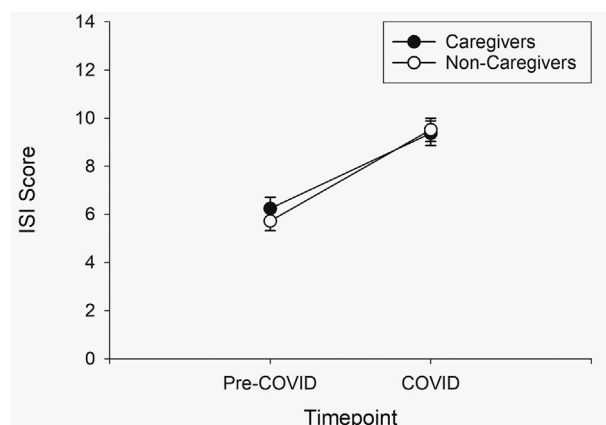

Fig. 3. Insomnia symptoms and severity increased significantly during COVID-19 for both caregivers (black circles) and non-caregivers (white circles). Capped vertical lines indicate standard error of the mean.

sleep quality and increases in insomnia for both caregivers and non-caregivers ($ps < 0.001$).

Discussion

This study investigated self-reported changes in drinking, sleep, and depression among family caregivers and non-caregivers during the COVID-19 pandemic. Responses were collected in the summer of 2020, when some areas in the United States were lifting COVID-related travel restrictions and mask mandates, but vaccines were not yet available. Both caregivers and non-caregivers reported that sleep problems, including worse sleep quality and increased insomnia symptoms, and depressive symptoms increased during the pandemic. However, only caregivers reported an increase in alcohol consumption. Further, changes in alcohol consumption were associated with changes in sleep among caregivers, such that increased drinking was associated with poorer sleep quality and more insomnia symptoms. By contrast, no significant relationships between change in alcohol use and sleep were found among non-caregivers. Finally, greater depressive symptoms were associated with decreased sleep quality and increased insomnia in both caregivers and non-caregivers. To our knowledge, our study is the first to explore the intersections of caregiving, sleep, alcohol use, and depression and as such adds to the growing, global body of literature
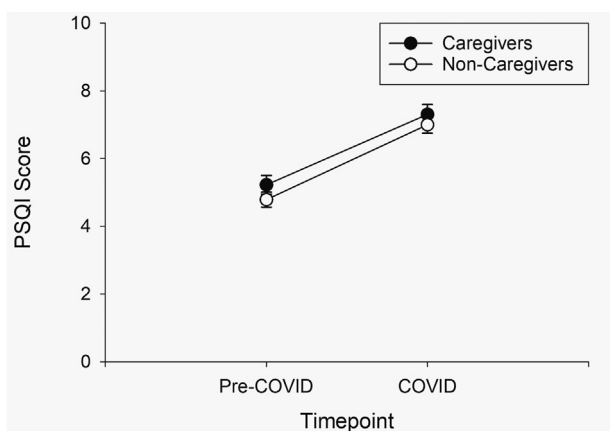

Fig. 2. Sleep quality became significantly worse during COVID-19 for both caregivers (black circles) and non-caregivers (white circles). Capped vertical lines indicate standard error of the mean.

Fig. 4. Depressive symptoms increased significantly during COVID-19 for both caregivers (black circles) and non-caregivers (white circles). Capped vertical lines indicate standard error of the mean.
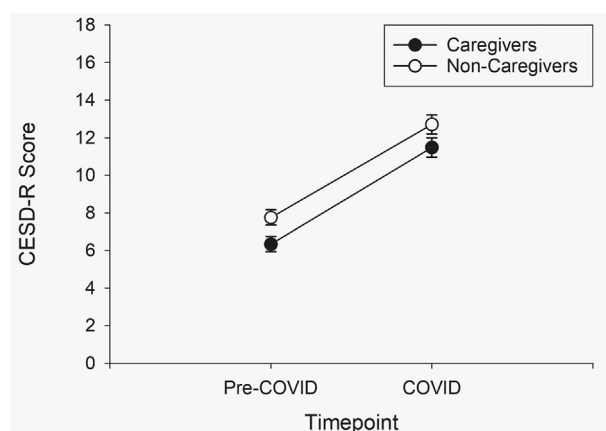
Table 2
Bivariate correlations between changes in alcohol use, sleep, and depression by caregiver status.

Non-caregivers				
Measure	AUDIT-C	PSQI	ISI	CESD-R
1. AUDIT-C	—			
2. PSQI	.086	—		
3. ISI	.121	.802**	—	
4. CESD-R	.174	.525**	.585**	—
Caregivers				
Measure	**AUDIT-C**	**PSQI**	**ISI**	**CESD-R**
1. AUDIT-C	—			
2. PSQI	.304**	—		
3. ISI	.267**	.818**	—	
4. CESD-R	.149	.604**	.571**	—

**Correlation is significant at the 0.01 level (2-tailed).
*Correlation is significant at the 0.05 level (2-tailed).

related to caregiving and health behaviors/outcomes during the pandemic. Additionally, we operationalized unpaid family caregivers (i.e., caregivers) as both those caring for children and/or older adults, thus capturing an important and understudied demographic.

Although the COVID-19 pandemic literature is nascent, our findings align with previous work showing that caregivers reported increased alcohol consumption during the pandemic. For instance, our findings are in line with previous reports from the United Kingdom and Canada showing that individuals living with children reported increased alcohol use during the pandemic (Ingram et al., 2020; Wardell et al., 2020). Our results align with both Ingram et al. (2020) and Wardell et al. (2020), in that alcohol use increased among those caring for children during the COVID-19 pandemic and non-caregivers reported slight decreases in alcohol use.

To our knowledge, this is the first study to show that increased drinking among caregivers during the COVID-19 pandemic was related to impaired sleep. Such an association is in line with the well-established "feed-forward" relationship between alcohol use and sleep problems (Koob & Colrain, 2020); that is, heavy alcohol use can impair sleep quality and, conversely, individuals often report drinking alcohol to help them sleep. This finding is not surprising given that caregivers also reported poorer sleep quality than non-caregivers, both before and during the COVID-19 pandemic. Unfortunately, our retrospective assessment and correlational analyses do not allow for causal inferences regarding whether increased alcohol consumption during the pandemic led to impaired sleep, or vice versa. It will be important for future studies to longitudinally assess changes in sleep and alcohol use to determine the directionality of this effect.

These results highlight the important differences in self-reported changes in alcohol consumption patterns between caregivers and non-caregivers during COVID-19 and suggest that caregivers may be at increased risk for negative health behaviors during difficult and stressful crises. Given that excessive alcohol use and sleep disorders can each have substantial negative consequences (Centers for Disease Control and Prevention, 2016; Colten, Altevogt, & Institute of Medicine, 2006), it is important to consider how changes in alcohol use and sleep during COVID-19 may impact caregivers' health and behavior. Caregivers may need additional attention from healthcare and mental health service professionals in order to minimize any long-term effects of increased alcohol use or sleep problems. Public health and behavioral interventions should also target caregivers, specifically, in order to address and manage sleep and alcohol use changes stemming from the COVID-19 pandemic.

This study had several limitations. First, the use of self-reported, retrospective analysis to assess baseline measures of alcohol use,

sleep, and mood prior to the pandemic is a clear limitation. Participants may not have been accurate in their reporting for a number of reasons, including demand characteristics, recall bias, or lack of motivation to complete the survey correctly (Dawson, 2003; Lauderdale, Knutson, Yan, Lui, & Rathouz, 2008). Although all measures used display strong validity and clinical significance, they reflect perceptions of alcohol use, sleep, and mood, and may not accurately reflect real-word health behaviors (Bradley et al., 2007; Fabbri et al., 2021; Mollayeva et al., 2016; Van Dam & Earleywine, 2011; Van Gils et al., 2021). This study is also limited in its measure of alcohol use, as the AUDIT-C briefly measures alcohol consumption and this study did not include other measures of alcohol use, such as consequences of drinking, craving, or health risks. Future studies should consider multiple aspects of alcohol use in relation to public health emergencies. Caregiving qualities (children vs. adults, number of children, age of children) were only quantified during the pandemic, and changes in caregiving caused by the pandemic, which may have impacted health behaviors, could not be considered. Additionally, our COVID-19 time point may not have necessarily measured the "height" of the pandemic, as COVID-19 responses were collected between June and August of 2020 when, as previously noted, many U.S. states and communities were relaxing quarantine restrictions, despite lack of a vaccine. Finally, sampling bias substantially limits the generalizability of results, as this sample was predominantly female, Caucasian, educated, and wealthy, which is not representative of the general population of the United States, and this population may have been differentially impacted by the pandemic compared to other populations. For example, more educated and wealthy individuals may have been able to adapt to work-from-home environments more easily and may have avoided increased stress due to potential job loss, unstable housing, or limited access to childcare. Additionally, our results cannot be generalized to non-English speakers, those without internet access, or individuals who do not identify as male or female. It will be important to consider the effects of the pandemic on health behaviors across different socioeconomic and demographic groups.

Despite these limitations, our study offers an important contribution to the scientific literature examining shifting health behaviors in the time of COVID-19. We conclude that, among our participants, caregivers were especially impacted by the COVID-19 pandemic, as they reported increased alcohol use and this increase in drinking was related to a perceived increase in sleep problems. Given the many negative effects of increased alcohol use and poor sleep, it may be helpful to develop public health resources specifically designed to reduce alcohol use and sleep problems among caregivers. This could help to prevent longer-term negative effects

and prepare for future emergencies or public health crises. Finally, additional research is needed to understand the long-term impacts of the pandemic on alcohol use, sleep, and depression in this population and to determine whether the retrospective changes reported here continue to impact health behaviors in the coming years.

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