COVID-19 Concerns, Perceived Stress, and Increased Alcohol Use Among Adult Women in the United States

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Abstract
The objective of this study was to assess the direct and indirect (via perceived stress) effects of different types of pandemic-related concerns and increased alcohol use among adult women in the United States (US). We conducted a secondary analysis of cross-sectional survey data from April 2020 for adult females in the US who use alcohol (n = 1,089). The indirect effect model accounted for 19% of the variance in perceived stress and 8% of the variance in reporting increased alcohol use compared to no change or decreased use. Path analysis results indicated that concerns about isolation (odds ratio [OR] = 1.027, 95% confidence interval [CI] = 1.013–1.046), job/finances (OR = 1.025, 95% CI = 1.007–1.065), basic needs (OR = 1.021, 95% CI = 1.008–1.047), and concerns about government (OR = 1.038, 95% CI = 1.014–1.179) were significantly related to reporting increased alcohol use through perceived stress. These findings can inform timely public health interventions to minimize alcohol-related harm among women.

Keywords
COVID-19, alcohol, stress, women

Introduction
The Centers for Disease Control and Prevention confirmed the first SARS-Cov-2 (COVID-19) case in the United States (US) in January 2020. The COVID-19 outbreak was declared a public health emergency in the US on February 3, 2020 and a national emergency on March 3, 2020. Between March and April 2020, most US states enacted numerous preventive mandates including strict “stay at home” orders and requested civilians only leave their home for essential reasons including medical care and grocery shopping. A rippling effect on the US economic system produced unprecedented employee layoffs, financial insecurity, and threatened personal and community stability. Initial epidemiological evidence found notable disparities in health behavior, health status, and related outcomes across sociodemographic groups (Gausman & Langer, 2020; Montenovo et al., 2020; Wolfson & Leung, 2020) and highlighted a need for researchers to develop agendas to address the short- and long-term inequities that could result from the COVID-19 pandemic (Kantamneni, 2020).

Adult women are a priority population of interest. Women experienced greater unemployment following the initial “stay at home” mandate (Montenovo et al., 2020) and minority women were especially impacted (Holder et al., 2021). In addition, caregiving responsibilities due to children attending school at home, tending to sick loved ones, and other factors (Beach et al., 2021, Lee et al., 2021) fell disproportionately on women (Giurge et al., 2021, Zamarro & Prados, 2021). Increased caregiving obligations hinder the ability for women to re-enter the workforce (Collins et al., 2021; Shaw et al., 2020) and are associated with greater symptoms of anxiety and depression (Russell et al., 2020). Thomas et al. (2021) noted that identifying as female, compared to male, predicted a 31%, 64%, 13%, and 94% increase in the number of stressful life events in domains of work/finances, home life, social activity, and healthcare, respectively.

Early research on alcohol use during the initial months of the pandemic indicated a 14% increase in frequency

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of alcohol use among women and a 19% increase among non-Hispanic Whites (Pollard et al., 2020). Longitudinal research supported these initial findings and further suggested that alcohol use declined for men and remained stable for women throughout the early months of the pandemic (Tucker et al., 2022). The psychosocial impact of COVID-19 on well-being can be described using the stress and coping model (Lazarus & Folkman, 1984) which posits that individuals appraise the significance of stressors (primary appraisal) and evaluate their own perceived resources (e.g., coping) to manage emotions or address the stressor. Alternatively, as described by Carver and Conner-Smith (2010, p. 685), coping can be conceptualized as “efforts to prevent or diminish threat, harm, and loss, or to reduce associated stress.” Furthermore, individuals can engage in approach coping (e.g., problem-solving or seeking information) or avoidance coping (e.g., maladaptive behavior or escape coping) behaviors, such as increasing one’s alcohol use. Concerns regarding the social, economic, and general lifestyle impact of COVID can be considered stressors that could produce an avoidance coping response, such as increasing alcohol use. There has been mixed evidence of sex differences in coping behaviors with one review suggesting women may be more likely to appraise a stressor as severe and that response to stress may be relative to one’s appraisal (Tamres et al., 2002). The goal of this study was to document the relationship between COVID-specific concerns (stressor) and changes in alcohol use (avoidance coping indicator) via perceived stress in a sample of adult women.

The proposed study builds on initial research indicating an increase in the frequency of alcohol use during the early months of the pandemic in a nationally representative sample of US adults (Pollard et al., 2020). Furthermore, early work that indicated sex differences in COVID-related patterns of alcohol use (Pollard et al., 2020) and specific stressful experiences during the pandemic (Giurge et al., 2021, Zamarro & Prados, 2021) should be considered in the context of the alcohol-related health disparities that disproportionately burden women as compared to men (e.g., alcohol-related liver disease, see Osna et al., 2017; loss of brain volume, see Hommer et al., 2001). According to role constraint theory (Sigmon et al., 1995), no gender differences in coping would be expected when men and women occupy the same roles. However, given evidence that women have experienced disproportionately high rates of unemployment and increased family responsibilities, we expect a different response to COVID-related stressors. Therefore, we limited the analysis to participants in our sample who identified as females. The goals of this study were twofold: (1) To assess the relationship between different types of pandemic-related concerns and increased alcohol use among adult women in the US during the early months in the COVID-19 pandemic and (2) to investigate the indirect effect of pandemic-related concerns on increased alcohol use through perceived stress.

Methods

Participants and Procedure

A nationwide online survey was administered between April 14 and April 22, 2020 while the stay-at-home recommendations were implemented in the US. Participants were recruited through a Facebook-Sponsored Ads campaign, which targeted the newsfeeds of 76,100 U.S. Facebook users, aged 18 years and older. The postings advertised for voluntary participation in an anonymous online study related to psychological responses to the COVID-19 pandemic. The posting provided a link directly to the Qualtrics survey, and of the 4,406 individuals who clicked on the posted link, 2,739 provided informed consent and completed the survey. This study is based on a subset of the respondents and includes only females who indicated that they use alcohol (N=1,089). The demographics of the subsample include a mean age of 46.8 (standard deviation [SD] = 12.9) with a range from 18 to 81 years. The racial/ethnic makeup is 92.1% White, 1.0% Black, 1.1% Asian, 0.1% American Indian or Alaskan Native, 1.0% Additional or Mixed Racial Groups, and 4.7% Hispanic or Latina. Of the 1,089 females who use alcohol, 471 (43.3%) responded indicating their alcohol use increased since the initial onset of the COVID-19 pandemic, whereas 618 (56.7%) indicated either no increase or a decrease in their alcohol use during this time. This study was approved by the Texas State University Institutional Review Board (#7221).

Measures

Demographics. Participants were asked to provide information regarding their age, gender, race/ethnicity, marital status, number of children under the age of 18 living at home, highest level of education attained, and current employment status.

Perceived Stress Scale. The Perceived Stress Scale (PSS) is a self-report measure that is well established to assess general life stressors (Cohen et al., 1983). Using a 4-point scale ranging from never (1) to very often (4), participants are asked to rate how often they experienced various situations in the past 4 weeks. An example of an item from the PSS is, “How often have you been upset because of something that happened unexpectedly?” Prior to summing the scores, 4 items are reversed scored. Higher total scores indicate greater perceptions of stress. The overall scale (M = 20.0, SD = 7.4) achieved an alpha reliability of 0.90 for this sample.

Pandemic-related concerns. The researchers for this study developed 27 specific statements for which the participants were asked to indicate their degree of concern use as visual analog scale ranging from 0 to 10, with higher values...
indicating more concern. A few examples of concerns included are as follows: access to non-COVID medical care, acquiring COVID (self/someone in household), cases of COVID reported, and staying employed. Cronbach’s alphas for the identified subscales range from 0.76 to 0.88 (see Table 2).

**Increase in alcohol use.** To measure increase in alcohol use, a single investigator-created item was presented to participants asking, “For each of the following behaviors, please indicate if they have Stayed the Same, Increased, Decreased, or are Not Applicable since the Stay-At-Home protocol for the COVID-19 Pandemic was initiated.” Participants were asked to respond to the use of alcohol and other behaviors. Only responses for alcohol use are included in the present analysis.

**Statistical Analysis**

The data collected from this study were statistically weighted to the total U.S. population based on the 2018 U.S. Census Bureau population estimates by age and race/ethnicity (using four age strata and four race/ethnicity strata; U.S. Census Bureau, 2020). Geographic clustering of data was accounted for using U.S. zip codes, such that cluster values assigned to each participant were based on the first two digits of their zip code (Fowler Jr., 2009). All analyses (independent t-tests for continuous variables and chi-square tests of independence for categorical variables) were adjusted for population weights and clusters, and were conducted using Complex Samples procedures in IBM SPSS version 27 (IBM, LLC., Chicago, IL, USA). Pairwise deletion was used for missing data. A Holm–Bonferroni Step-Down method was used to control for the potential of type I error inflation due to multiple comparisons. A principal components analysis with a varimax rotation was conducted to reduce the 27 COVID-19-specific concern items to components with eigenvalues greater than one.

To examine the second aim of this study (i.e., assess the indirect effect of perceived stress on the relationship between pandemic concerns and an increase in alcohol use), we specified a path analysis model Mplus v 8.6 using robust full information maximum likelihood estimation. We adjusted each model for age, marital status, race, presence of minor children in household, and education level based on previous research supporting relationships of each of these variables with stress and alcohol behaviors (e.g., Blazer & Wu, 2009; Bryant & Kim, 2019; Cohen & Janicki-Deverts, 2012; Dinescu et al., 2016; Kerr et al., 2009; Keyes et al., 2015; Rodriguez et al., 2020). Concerns variables were specified to covary. We specified all direct pathways from each concern component to both PSS and increase in alcohol use, the direct pathway from PSS to increase in alcohol use, and all potential indirect effects from all concerns variables to increased alcohol use through PSS (seven total indirect pathways). All confidence intervals (CIs) were estimated with 1,000 bootstrap samples (B. O. Muthén et al., 2016), in which 95% CI for parameters that did not cross zero were interpreted as significant. The identification of significant indirect effects was based on counterfactuals, a nonparametric technique for causal inference of mediating or indirect effects with randomized or nonrandomized designs (Valente et al., 2020). It is a particularly recommended method when the outcome variable in a mediation or indirect effect analysis is binary (B. O. Muthén, 2011; B. O. Muthén et al., 2016). We examined the pure natural indirect effects, which indicated in the present model that the effect of the respective concerns variable on Increase in alcohol use was only indirect through PSS (B. O. Muthén, 2011). The criteria for identifying a significant indirect effect were that the p value for the B coefficient was < .05 and the 95% CI for the odds ratio (OR) of the indirect effect did not cross a threshold of 1. Analyses were conducted using IBM SPSS version 27 (IBM, LLC.) and Mplus v 8.6 (L. K. Muthén & B. O. Muthén, 2017).

**Results**

**Descriptive Results**

Women who increased alcohol use were more likely to be between the ages of 25 and 44 years of age (48.9% vs. 33.4%; p = .004) and less likely to be between the ages of 45 and 64 (26.5% vs. 31.3%; p = .004) or aged 65 years or older (9.8% vs. 20.2%; p = .004) (Table 1). Married women (56.1% vs. 43.0%; p = .019) and women with children younger than 18 in the household (37.3% vs. 26.3%; p = .016) were also more likely to report increased alcohol use. Mean scores on the PSS were also significantly higher among women with increased alcohol, compared to women with no alcohol increase (21.6 vs. 18.5; p = .006). Increased alcohol use was not associated with race/ethnicity, education level, or employment status in unadjusted analyses (Table 1).

**Principal Components Analysis Results**

Results from principal components analysis of the 27 COVID-19-specific concerns suggest six underlying components of concern, each with eigenvalues greater than 1 (Table 2). The six components accounted for 66.4% of the cumulative variance across all items and included concerns about (1) concerns about COVID-19 (testing/infection/case statistics), (2) access to basic needs, (3) the government’s response to the pandemic, (4) childcare and schooling of underaged children, (5) employment and finances, and (6) Caring for or unable to visit elderly
Table 1. Increases in Alcohol Use for Women During Initial Onset of COVID-19 Pandemic: Demographic Comparisons.

|                        | Alcohol | Alcohol | Significance |
|------------------------|---------|---------|--------------|
|                        | No increase | Increased use | |
| Age                    | Mean (95% CI) | 46.0 (42.6, 49.4) | 40.9 (36.3, 45.6) | p = .006 |
|                        | 18–24 | 15.2% (7.0, 29.8) | 14.8% (7.7, 26.4) | p = .004 |
|                        | 25–44 | 33.4% (24.2, 44.1) | 48.9% (39.8, 58.0) | |
|                        | 45–64 | 31.3% (24.3, 39.2) | 26.5% (19.2, 35.4) | |
|                        | 65+ | 20.2% (15.5, 25.7) | 9.8% (5.2, 17.8) | |
| Race/ethnicity         | White | 63.9% (52.9, 73.7) | 63.0% (44.2, 78.5) | p = .640 |
|                        | Black | 13.9% (5.9, 29.6) | 10.6% (3.9, 25.8) | |
|                        | Hispanic | 15.3% (8.5, 26.0) | 20.2% (8.7, 40.4) | |
|                        | Additional racial/ethnic groups | 6.8% (1.8, 22.9) | 6.2% (3.2, 11.5) | |
| Marital status         | Single | 40.6% (33.4, 48.1) | 36.3% (27.0, 46.7) | p = .019 |
|                        | Married | 43.0% (35.1, 51.2) | 56.1% (46.1, 65.5) | |
|                        | Separated/divorced | 12.6% (9.2, 17.0) | 6.7% (5.0, 8.8) | |
|                        | Widowed | 3.9% (2.5, 6.0) | 1.0% (0.3, 3.0) | |
| Children in household  | Children ≤ 18 years | 26.3% (21.4, 31.9) | 37.3% (31.9, 43.1) | p = .016 |
| Education level        | High school or less | 4.3% (2.7, 6.7) | 3.5% (1.7, 7.1) | p = .913 |
|                        | Some college | 33.3% (24.7, 43.3) | 31.9% (22.5, 43.2) | |
|                        | 4-Year degree | 28.1% (21.2, 36.3) | 29.5% (23.4, 36.5) | |
|                        | Graduate/professional degree | 34.3% (22.4, 48.5) | 35.0% (29.2, 41.3) | |
| Employment status      | Working primarily from home | 40.4% (33.1, 48.2) | 44.0% (34.0, 54.5) | p = .056 |
|                        | Working primarily outside of home | 13.5% (9.5, 18.7) | 9.8% (7.1, 13.4) | |
|                        | Unemployed—COVID | 13.5% (10.4, 17.2) | 21.9% (13.7, 33.1) | |
|                        | Unemployed—not COVID | 4.0% (2.2, 7.3) | 4.3% (2.7, 6.7) | |
|                        | Other (retired, student, SAHM, etc.) | 28.6% (23.6, 34.1) | 20.0% (14.8, 26.3) | |
| Perceived stress scale | Mean (95% CI) | 18.5 (17.2, 19.8) | 21.6 (20.5, 22.7) | p = .006 |

Note. Column percentage or means with 95% CIs provided. CIs = confidence intervals, SAHM = stay at home mom. Bold values represent significant differences as indicated by non-overlapping confidence intervals and point estimates.

parents. One item, concern about isolation for a long period of time, did not load on any component (β = .16) and was analyzed separately.

Women who increased alcohol use had significantly higher mean scores for component 5, concerns about job/finances, compared to women with no alcohol increase (5.5 vs. 5.0; p = .012) (Table 3). No other component scores differed significantly between women with and without increases in alcohol use. However, there were eight individual items whose mean scores differed between women with and without increases in alcohol use, including access to household supplies (5.2 vs. 4.7; p = .005), whether government can provide access to medical resources (7.5 vs. 7.1; p = .024), whether government can stabilize the economy (7.7 vs. 7.3; p = .008), helping with remote schooling (5.3 vs. 4.1; p = .010), providing activities for children (5.4 vs. 4.5; p = .025), staying employed (5.9 vs. 5.4; p = .033), maintaining income/paying bills (6.2 vs. 5.6; p = .045), and isolation for long time (6.0 vs. 5.4; p = .007).

Path Analysis
Detailed numeric results for the direct effects analysis are shown in Table 4 and the path model with standardized beta estimates for significant pathways is illustrated in Figure 1. All concerns variables were positively correlated with each other in the path analysis, except for the following: concerns about isolation with concerns for elderly parents (p = .095); concerns about the government’s response to the pandemic with (each) concerns about children (p = .321), concerns about job/finances (p = .064), and concerns about elderly parents (p = .763). When adjusted for
Table 2. Results from Principal Components Analysis with Varimax Rotation.

| Component 1: concerns about COVID (\(\alpha = .87\)) | Component eigenvalues 7.54 |
|------------------------------------------------------|-----------------------------|
| Access to COVID testing                               | 0.58                        |
| Acquiring COVID for self                              | 0.69                        |
| Acquiring COVID for those in household                | 0.61                        |
| Access to COVID treatment                             | 0.69                        |
| Cases of COVID reported                               | 0.91                        |
| Hospitalizations reported                             | 0.92                        |
| Deaths reported                                       | 0.90                        |

| Component 2: concerns about basic needs (\(\alpha = .84\)) | Component eigenvalues 3.55 |
|-------------------------------------------------------------|-----------------------------|
| Access to food                                              | 0.80                        |
| Access to water                                             | 0.77                        |
| Access to household supplies                                | 0.73                        |
| Access to non-COVID medication                              | 0.75                        |
| Access to non-COVID medical care                            | 0.65                        |

| Component 3: concerns about government (\(\alpha = .86\)) | Component eigenvalues 2.80 |
|-----------------------------------------------------------|-----------------------------|
| Can provide access to medical resources                   | 0.82                        |
| Can provide access to non-medical resources (food/supplies)| 0.84                        |
| Can provide funds to unemployed                           | 0.74                        |
| Can stabilize the economy                                 | 0.79                        |
| Is providing truthful information                         | 0.81                        |

| Component 4: concerns about children (\(\alpha = .88\)) | Component eigenvalues 2.00 |
|---------------------------------------------------------|-----------------------------|
| Working from home without childcare                      | 0.75                        |
| Helping with remote schooling                            | 0.87                        |
| Providing activities for children                        | 0.91                        |
| Maintaining screen time limits for children              | 0.84                        |

| Component 5: concerns about job/finances (\(\alpha = .83\)) | Component eigenvalues 1.48 |
|-------------------------------------------------------------|-----------------------------|
| Staying employed (self/significant other)                   | 0.89                        |
| Maintaining income/paying bills                            | 0.86                        |
| Able to work from home                                     | 0.69                        |

| Component 6: concerns about elderly parents (\(\alpha = .76\)) | Component eigenvalues 1.23 |
|----------------------------------------------------------------|-----------------------------|
| Caring for older parents                                     | 0.86                        |
| Not seeing older parents                                     | 0.84                        |

The item for concerns about isolation for long time did not load on any of the six components and is not shown in Table 2.

All other variables in the model, the only concerns component directly related (positively) to increased alcohol use was concerns about the government’s response to the pandemic. PSS was strongly related to increased alcohol use. In addition, concerns about isolation, concerns about basic needs, concerns about the government’s response to the pandemic, and concerns about job/finances were all related to higher levels of PSS.

Counterfactual-based pure natural indirect effects (i.e., Concern \([X_1] \rightarrow\) PSS [M] \(\rightarrow\) increased alcohol use \([Y]\)) were examined next. There were significant indirect effects through PSS to increased alcohol use for the following concerns variables: isolation \((B = .006, SE = 0.002, p < .001, OR = 1.027, 95\% CI = 1.013–1.046); basic needs \((B = .005, SE = 0.002, p = .040, OR = 1.021, 95\% CI = 1.008–1.047); government’s response to the pandemic \((B = .009, SE = 0.003, p = .005, OR = 1.038, 95\% CI = 1.014–1.179); and job/finances \((B = .006, SE = 0.002, p = .008, OR = 1.025, 95\% CI = 1.007–1.065)."

Discussion

The goals of this study were twofold. First, we aimed to assess the relationship between different types of pandemic-related concerns and increased alcohol use among adult women in the US during the early months in the COVID-19 pandemic. Our findings showed higher scores surrounding concerns around job and finances were associated with increased alcohol use in addition to individual items related to concerns about basic needs, government, children, and job/finances. Concerns regarding COVID-19 (such as testing and infection) as well as concerns regarding elderly parents...
Table 3. Increases in Alcohol Use for Women During Initial Onset of the COVID-19 Pandemic: Comparisons of Pandemic-Related Concern Items and Component Scores.

| Component | Alcohol no increase | Alcohol increased use | Significance |
|-----------|---------------------|-----------------------|--------------|
| Component 1: concerns about COVID | 6.8 (6.6, 7.0) | 7.0 (6.7, 7.2) | p = .321 |
| Access to COVID testing | 7.0 (6.7, 7.3) | 6.9 (6.6, 7.2) | p = .675 |
| Acquiring COVID for自己 | 5.9 (5.7, 6.1) | 5.8 (5.5, 6.1) | p = .465 |
| Acquiring COVID for those in household | 6.6 (6.3, 6.9) | 6.7 (6.4, 7.0) | p = .624 |
| Access to COVID treatment | 6.8 (6.5, 7.1) | 7.0 (6.7, 7.4) | p = .291 |
| Cases of COVID reported | 7.5 (7.3, 7.7) | 7.5 (7.3, 7.8) | p = .982 |
| Hospitalizations reported | 7.4 (7.2, 7.6) | 7.6 (7.3, 7.8) | p = .306 |
| Deaths reported | 7.6 (7.4, 7.9) | 7.8 (7.5, 8.0) | p = .426 |
| Component 2: concerns about basic needs | 4.2 (3.9, 4.4) | 4.4 (4.1, 4.6) | p = .307 |
| Access to food | 4.1 (3.9, 4.4) | 4.4 (4.1, 4.7) | p = .117 |
| Access to water | 2.6 (2.4, 2.9) | 2.8 (2.5, 3.0) | p = .476 |
| Access to household supplies | 4.7 (4.4, 4.9) | 5.2 (4.9, 5.5) | p = .005 |
| Access to non-COVID medication | 4.3 (4.0, 4.6) | 4.6 (4.3, 5.0) | p = .084 |
| Access to non-COVID medical care | 6.0 (5.7, 6.3) | 6.0 (5.7, 6.3) | p = .996 |
| Component 3: concerns about government | 7.1 (6.9, 7.3) | 7.3 (7.0, 7.5) | p = .447 |
| Can provide access to medical resources | 7.1 (6.9, 7.3) | 7.5 (7.3, 7.7) | p = .024 |
| Can provide access to non-medical resources (food/supplies) | 6.8 (6.6, 7.0) | 7.1 (6.8, 7.3) | p = .101 |
| Can provide funds to unemployed | 6.9 (6.7, 7.1) | 7.1 (6.8, 7.3) | p = .318 |
| Can stabilize the economy | 7.3 (7.1, 7.5) | 7.7 (7.5, 7.9) | p = .008 |
| Is providing truthful information | 7.7 (7.5, 7.9) | 7.8 (7.6, 8.0) | p = .455 |
| Component 4: concerns about children | 4.5 (4.0, 4.9) | 5.0 (4.5, 5.4) | p = .115 |
| Working from home without childcare | 4.0 (3.4, 4.6) | 4.3 (3.7, 4.9) | p = .425 |
| Helping with remote schooling | 4.1 (3.5, 4.7) | 5.3 (4.6, 5.9) | p = .010 |
| Providing activities for children | 4.5 (3.9, 5.1) | 5.4 (4.8, 5.9) | p = .025 |
| Maintaining screen time limits for children | 4.3 (3.6, 4.9) | 4.7 (4.1, 5.2) | p = .393 |
| Component 5: concerns about job/finances | 5.0 (4.7, 5.2) | 5.5 (5.2, 5.8) | p = .012 |
| Staying employed (self/significant other) | 5.4 (4.0, 5.7) | 5.9 (5.5, 6.3) | p = .033 |
| Maintaining income/paying bills | 5.6 (5.3, 5.9) | 6.2 (5.8, 6.5) | p = .045 |
| Able to work from home | 4.0 (3.6, 4.3) | 4.4 (3.9, 4.8) | p = .151 |
| Component 6: concerns about elderly parents | 5.3 (4.9, 5.6) | 5.1 (4.7, 5.5) | p = .570 |
| Caring for older parents | 4.5 (4.2, 5.0) | 4.2 (3.8, 4.6) | p = .224 |
| Not seeing older parents | 6.1 (5.6, 6.5) | 6.2 (5.8, 6.6) | p = .649 |
| Concerns about isolation for long time | 5.4 (5.1, 5.7) | 6.0 (5.6, 6.4) | p = .007 |

Note: Means with 95% CIs provided. Ratings from 1 to 10 with 10 being highest concern. CIs = confidence intervals. Concerns about isolation for long time did not load on any of the six components but is significantly associated with alcohol use increase.

There is extensive empirical evidence that alcohol use and misuse among women in the US increased during the COVID-19 pandemic (e.g., Barbosa et al., 2021; Nesoff et al., 2021; Pollard et al., 2020). We cannot ascertain whether women in the current study were drinking hazardous amounts of alcohol. However, in the context of the broader literature on alcohol use among women during COVID-19, this study is an important step toward understanding some of the reasons why women drank more alcohol at the time and may help inform tailored intervention and policy strategies to reduce alcohol use and ultimately alcohol-related harm among women.

To our knowledge, this is the first study to investigate the relationship between multiple COVID-related concerns and alcohol use behavior during the early phase of the pandemic. Concerns related to kids, basic needs, job/finances, and government explained 19% of the variance in perceived stress scores. Perceived stress was significantly associated with increased alcohol use among women suggesting a complex relationship between the two.
Table 4. Direct Effects of Path Analysis.

| Predictors                  | Increase in alcohol use | Perceived stress |
|-----------------------------|-------------------------|------------------|
|                             | $B$  | $SE$  | LLCI  | ULCI  | $p$  | OR   | $B$  | $SE$  | LLCI  | ULCI  | $p$  |
| Concerns, isolation        | 1.02 | 0.03  | −0.04 | 0.08  | .538 | 1.02 | .48  | 0.11  | 0.22  | 0.67  | <.001|
| Concerns, COVID            | .00  | 0.04  | −0.08 | 0.06  | .954 | 1.00 | .01  | 0.14  | −0.30 | 0.23  | .950 |
| Concerns, basic needs      | −.01 | 0.06  | −0.11 | 0.12  | .889 | 0.99 | .39  | 0.15  | 0.15  | 0.72  | .009 |
| Concerns, government       | .08  | 0.03  | −0.01 | 0.14  | .015 | 1.08 | .68  | 0.19  | 0.25  | 1.02  | <.001|
| Concerns, children         | −.02 | 0.03  | −0.11 | 0.01  | .460 | 0.98 | −.08 | 0.09  | −0.31 | 0.10  | .398 |
| Concerns, job/finances     | .06  | 0.04  | −0.03 | 0.11  | .123 | 1.06 | .44  | 0.13  | 0.20  | 0.70  | .001 |
| Concerns, elderly parents  | −.06 | 0.04  | −0.11 | 0.04  | .144 | 0.94 | .02  | 0.10  | −0.19 | 0.20  | .823 |
| Perceived stress           | .06  | 0.02  | 0.03  | 0.10  | .002 | 1.06 | −.14 | 0.03  | −0.21 | −0.10 | <.001|

Covariates

| Age                         | −.02 | 0.01  | −.04 | 0.01 | .052 | 0.98 | −.14 | 0.03  | −0.21 | −0.10 | <.001|
| Marital status              | .86  | 0.28  | 0.21 | 1.32 | .002 | 2.36 | −.54 | 0.64  | −1.86 | 0.72  | .399 |
| Race                        | −.21 | 0.44  | −1.18 | 0.67 | .628 | 1.28 | −1.13 | 1.04  | −3.92 | 0.30  | .278 |
| Minor children              | .25  | 0.26  | −0.08 | 0.94 | .348 | 0.81 | .58  | 0.65  | −0.75 | 1.88  | .372 |
| Education                   | −.00 | 0.06  | −0.15 | 0.10 | .970 | 1.00 | .15  | 0.22  | −0.30 | 0.55  | .477 |

Note. Analytic $N = 1,072$. Marital status (0 = not married, 1 = married), race (0 = not White, 1 = White), minor children (0 = no minor children, 1 = minor children); LLCI and ULCI are lower limit and upper limit, respectively, 95% bootstrapped CIs. CIs = confidence intervals.

Figure 1. Significant direct effects from path model analysis. Loglikelihood = −25478.58; AIC = 51121.16; BIC = 51529.29; standardized beta estimates provided for significant regression pathways. Gray lines indicate nonsignificant relationship. Pathways to PSS and increased alcohol use are adjusted for statistical covariates (age, race, marital status, parental status, and education). $R^2$ for PSS is variance accounted for by the concerns variables and statistical covariates and $R^2$ for increased alcohol use characterizes the proportion of variance that is explained in the underlying continuous latent response variable (see equation (15), B. O. Muthén (1998–2004)). Indirect effect analysis based on counterfactuals shows that the following indirect pathways are significant: isolation $\rightarrow$ PSS $\rightarrow$ increased alcohol use ($p < .001$); basic needs $\rightarrow$ PSS $\rightarrow$ increased alcohol use ($p = .040$); government $\rightarrow$ PSS $\rightarrow$ increased alcohol use ($p = .005$); job/finances $\rightarrow$ PSS $\rightarrow$ alcohol use ($p = .009$).

Note. AIC = Akaike information criterion; BIC = Bayesian information criterion; PSS = Perceived Stress Scale.

The relationship between COVID-19-related experiences, mental health, and alcohol use behavior. This study supports previous calls to address comorbid mental and behavioral health issues (Czeisler et al., 2020, 2021) and further suggests that techniques to reduce stress should be specifically tailored to current issues since individuals varied on their responses about the concerns. Moreover, the wide range of COVID-19 concerns may be important targets to address through a combination of policy-level and community-level interventions.

Underscoring the importance of a concerted effort to research correlates of distress and alcohol use among women specifically, Rodriguez et al. (2020) found that COVID-19-related distress was related to more alcohol consumption (i.e., typical drinks and peak drinking) among women than...
men. The indirect effect of COVID-19-related concerns to increased alcohol use through perceived stress in this study may be partially explained by coping motives for drinking alcohol, such as drinking to forget worries or avoid problems. Cross-sectional research with adult alcohol users found drinking to cope was associated with increased alcohol use and problems among drinkers with children under age 18 (Wardell et al., 2020) and also accounts for the relationship between decreased environmental reward and heavier alcohol use (McPhee et al., 2020). While drinking to cope predicted short-term changes in alcohol use among women following social distancing mandates, only social motives (i.e., drinking for pleasure) predicted long-term changes in alcohol use for women (Tucker et al., 2022).

Although having children and marital status were included as statistical covariates in this study’s path model, findings pertaining to those variables warrant some discussion given that the population of interest for this study is adult women in the US. Women take on a significantly larger share of housework and caregiving duties than men (International Labor Organization, 2016), which is consistent with some traditionally feminine gender role scripts that have been identified by researchers (e.g., Mahalik et al., 2005). Although gender roles in terms of division of labor and familial responsibilities are shifting, they are not yet equitable (Horowitz et al., 2017). Traditionally, feminine gender roles and the ongoing disparities in household and familial labor potentially underlie some of the findings on alcohol use among women during the pandemic that are noted in this study and elsewhere (e.g., Rodriguez et al., 2020). That is, findings from this study indicated that having children was associated with increased alcohol use (during preliminary analysis) as was being married (during both preliminary and primary analyses). The stress from these roles was undoubtedly compounded during the early stages of the COVID-19 pandemic during emergency transitions to virtual learning and work, while families were confined together for an extended period of time. Perhaps even more relevant to the current study’s model, many of the pandemic-related concerns in this study may have been particularly salient—and stressful—to many women in light of traditionally feminine prescriptions asserting that their role is to protect their family as well as themselves.

There are several limitations readers should consider when interpreting the conclusions of this work. First, these results are cross-sectional, and we cannot conclude causal relationships exist. Interpretation of the indirect effects observed here should be done with caution, and future research using longitudinal designs are needed to assure the direction of causation are as hypothesized (Maxwell & Cole, 2007). In addition, the data collected are not representative of the U.S. population as they disproportionately represent non-Hispanic White female adults. We accounted for this limitation in this study by applying census-based population weights in the analyses. Distinct patterns of alcohol use and misuse are often identified across women from diverse racial and ethnic backgrounds (e.g., Bryant & Kim, 2019; Keyes et al., 2015) and alcohol-related health disparities disproportionately burden women of color compared to White women (e.g., Kerr et al., 2011). However, future research would benefit from collecting data from a sample that includes more participants from minoritized racial and ethnic backgrounds so that meaningful subgroup comparisons on pandemic-related concerns and changes in alcohol use can be examined. Also, our work looks at short-term changes in alcohol use and it is important future research continue to track and understand factors contributing to gender-specific increases in alcohol use over time. Next, these data were self-reported and we are not able to approximate exact changes in the frequency or quantity of use due to the wording of survey items. It is assumed that women who quit using alcohol during the stay-at-home protocol marked the response as Decrease, since quitting use was not an option. Furthermore, self-report measures are subject to participant biases, including social desirability, which may provide underestimates of their use of alcohol. As with all empirical research, the potential of missing third variables is a limitation. Finally, given the constraints on conducting human subjects research during a pandemic and that Facebook was estimated to have over 290 million users in the US in 2020 (Statista, 2022), Facebook is a large, population-based, and ethically appropriate choice for recruitment and data collection. However, our specific Facebook-targeted ad campaign may not have resulted in a representative sample of the adult female population, as it would only have reached users of this social media platform who also happened to see the ad on their news feed.

Conclusion

Reducing risk for alcohol-related problems and future alcohol use disorder should be an urgent priority for nursing and public health professionals as emerging evidence suggests adults are not only drinking more but experiencing alcohol-related problems since the initial pandemic mandates were implemented in 2020 (Ramalho, 2020; Xu et al., 2021). This study presents important evidence on how pandemic-related concerns and perceived stress are associated with increased alcohol use among women. Future research is needed to understand how COVID-related concerns evolve over phases of the pandemic, as well as examines changes in social stress and drinking behaviors.

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