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Understanding the impact of the COVID-19 pandemic on stress, mood, and substance use among young adults in the greater Minneapolis-St. Paul area: Findings from project EAT

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ABSTRACT

Rationale: There is a need to understand how the ongoing COVID-19 pandemic has affected the mental and behavioral health of young adults in the U.S.

Objective: This study used quantitative and qualitative survey data to identify young adults at highest risk for psychological distress during the U.S. outbreak of COVID-19 and to further understand how the pandemic has impacted their stress, mood, and substance use.

Methods: Participants were 670 young adult cohort members (ages 21–29) of the population-based longitudinal study EAT 2010–2018 who participated in the C-EAT study (COVID-19 Eating and Activity over Time).

Results: Among the sample, 84% ($n = 561$) reported pandemic-related changes to their mood or stress and 33% ($n = 221$) reported changes to their substance use. Linear regression analyses identified several meaningful risk factors for higher psychological distress during the pandemic, including female gender, White race, higher pre-pandemic depressive symptoms and perceived stress, and lower pre-pandemic stress management ability. A thematic analysis further identified five major themes related to changes in stress and mood following the COVID-19 outbreak describing specific emotional reactions, stress related to the direct impact of the pandemic as well as interpersonal connectedness and economic factors, and strategies for managing stress. In addition, two major themes were identified related to substance use during the pandemic detailing specific changes in and motivations for substance use.

Conclusions: These findings underscore the need to develop effective, scalable, and rapidly deployable public health resources that target the stressors commonly experienced among young adults to improve their psychological wellbeing during this pandemic.

1. Introduction

The COVID-19 pandemic is a global public health emergency that poses significant challenges to mental and emotional wellbeing (Galea et al., 2020; Torales et al., 2020). Efforts to mitigate the spread of COVID-19, including mandatory quarantines, lockdowns, and physical distancing recommendations, have upended the status quo for nearly every global citizen. The impact of these mitigation efforts in conjunction with the persistent threat of COVID-19 infection have created

innumerable stressors (Huang and Zhao, 2020; Park et al., 2020) that have contributed to rising levels of psychological distress, characterized by feelings of stress, anxiety, depression, and uncertainty (Liu et al., 2020; Rettie and Daniels, 2020; Shanahan et al., 2020; Taylor et al., 2020). Although it is too early to fully quantify the mental health consequences of the COVID-19 pandemic, inferences based on research from prior pandemics and natural disasters suggest that the psychological impact of the current pandemic is likely to be significant and longstanding (Brooks et al., 2020; Raker et al., 2020; Wheaton et al.,

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2012). Initial evidence has shown that the early outbreak of COVID-19 and subsequent implementation of stay-at-home orders were associated with high levels of psychological distress (Pierce et al., 2020; Rettie and Daniels, 2020; Rodríguez-Rey et al., 2020; Tull et al., 2020) that appear to remain relatively stable over time (Wang et al., 2020). Thus, understanding the impact of the COVID-19 pandemic on mental health outcomes has the potential to inform rapidly developing intervention efforts aimed at improving psychological wellbeing during the current crisis.

The psychological impact of the COVID-19 pandemic has not affected all members of the population equally. Emerging evidence has identified several populations at risk for high levels of psychological distress during the pandemic, including women (Rodríguez-Rey et al., 2020; Tull et al., 2020), individuals living in low-income homes (Pierce et al., 2020), and those with prior histories of mental illness (Alonzi et al., 2020; Rettie and Daniels, 2020). Additional reports have documented that young adults are at higher risk for pandemic-related psychological distress than other age groups (Huang and Zhao, 2020; Pierce et al., 2020; Rettie and Daniels, 2020; Rodríguez-Rey et al., 2020; Tull et al., 2020; Wang et al., 2020), a finding consistent with previous research on pandemics and natural disasters (An et al., 2019; Su et al., 2007). It has been suggested that young adults may be especially likely to experience heightened psychological distress in response to the COVID-19 pandemic due to factors such as frequent media exposure to the crisis (Qiu et al., 2020), high levels of loneliness (Luchetti et al., 2020), greater lifestyle and economic disruptions, and a perceived loss of job and educational opportunities (Liu et al., 2020; Shanahan et al., 2020). Despite this evidence, limited work has explored how young adults are experiencing and responding to the stressors associated with the COVID-19 pandemic. Although one study found relatively high rates of adaptive coping strategies, such as exercise and positive reappraisal, among young adults in response to the pandemic (Shanahan et al., 2020), others have found substantial increases in substance use as a means of coping with pandemic-related stressors (Charles, 2020; Lechner et al., 2020). This trend is particularly concerning given the overall rise in substance use observed since the onset of the pandemic among adults generally (Czeisler et al., 2020; Dubey et al., 2020) and warrants further attention.

The present study aimed to extend prior research by identifying young adults at greatest risk for poor psychological adjustment in response to the COVID-19 pandemic and to further understand how the pandemic has impacted stress levels, mood, and substance use. To investigate these aims, this study collected quantitative and qualitative survey data from a population-based sample of young adults who were part of an ongoing cohort study in the greater Minneapolis-St. Paul area. Longitudinal associations were first examined between young adults' sociodemographic factors (i.e., age, gender, race, and socioeconomic status [SES]) and pre-pandemic levels of psychological adjustment to identify those at highest risk for depressive symptoms, perceived stress, and low ability to manage stress during the COVID-19 pandemic. A thematic analysis was then conducted on write-in responses to open-ended survey questions to assist with the interpretation of the quantitative findings and to gain further insight into how young adults perceived and experienced changes to experienced stress, mood, and substance use in response to the pandemic. These findings can be used to inform intervention and policy efforts aimed at improving the health and wellbeing of young adults during the COVID-19 pandemic by identifying those who are especially vulnerable to psychological distress and by giving voice to these young adults to better understand their needs during the COVID-19 pandemic.

2. Methods

2.1. Study design and sample

Participants in the C-EAT (COVID-19 Eating and Activity over Time)

study were members of the EAT 2010–2018 longitudinal study cohort who were invited to complete a follow-up, online survey in 2020 during the U.S. outbreak of COVID-19. The EAT 2010–2018 study is a population-based investigation of weight-related health behaviors and associated factors among young people who were attending secondary school in Minneapolis-St. Paul, Minnesota in 2009–2010 (Arcan et al., 2014; Larson et al.). The C-EAT survey was designed to capture changes in weight-related health and markers of psychosocial wellbeing during the COVID-19 outbreak. Email and text message invitations to participate in the C-EAT survey were sent to the 1568 cohort members who had completed the most recent follow-up survey in 2017–2018. Invitations and up to five reminders to participate were sent during the months of April to October 2020, and responses were received from 46% percent of the sample ($n = 720$). All participants were mailed a financial incentive following survey completion. The University of Minnesota Institutional Review Board Human Subjects Committee approved all protocols.

The C-EAT survey sample included 447 women, 263 men, and 10 participants of other gender identity. The sample had a mean age of 14.3 ± 2.0 years at baseline in 2009–2010 and 24.7 ± 2.0 years at follow-up in 2020. Although C-EAT survey participants were less likely than 2018 survey participants to be men, identify their race as Black/African American, and have a parent of lower SES, the respondents in 2020 were of diverse backgrounds. The distribution of ethnic/racial backgrounds reported by participants was similar but more diverse than the overall population in Minneapolis-St. Paul, Minnesota (U.S. Census Bureau, 2019), with 30% White ($n = 213$), 24% Asian American ($n = 172$), 18% Black/African American ($n = 131$), 17% Hispanic/Latinx ($n = 119$), and 12% mixed or other race ($n = 85$). Approximately half of residents in Minneapolis-St. Paul, Minnesota are non-Hispanic White and just under 10% identify as Hispanic/Latinx (U.S. Census Bureau, 2019). The distribution across categories of parental SES based primarily on baseline educational attainment was: 33% low ($n = 231$), 21% low-middle ($n = 146$), 17% middle ($n = 120$), 19% upper-middle ($n = 131$), and 11% high ($n = 79$). Most survey respondents (90%) were living in Minnesota at the time they completed the 2020 C-EAT survey.

Although a complete description of how the state and U.S. federal governments responded to the COVID-19 outbreak is beyond the scope of this article, it is important to provide some context to the Minnesota state regulations that were put in place to prevent the spread of COVID-19 during the survey period from April through October 2020. From March 27, 2020 through May 17, 2020, Minnesota was under a stay-at-home order (Executive Order 20-20), during which non-essential businesses remained closed from a previous order (Executive Order 20-04), and individuals were directed to only go outside of their homes for essential needs. After the stay-at-home order expired, the state took a phased approach to reopening by continuing to limit social gatherings, encouraging individuals to work from home, and allowing non-essential businesses to reopen with capacity restrictions and other safety regulations (Executive Order 20-56). A statewide mask mandate was later enacted on July 22, 2020 (Executive Order 20-81). The regulations surrounding social gatherings and businesses as well as the mask mandate continued to remain in effect through October 2020 when the survey period ended. At the time of survey completion, young adults aged 20–29 accounted for 24% of all total COVID-19 cases in the state of Minnesota but accounted for less than 1% of all COVID-19-related hospitalizations and deaths (Minnesota Department of Health, 2020). The difficult situation due to the COVID-19 pandemic was further compounded in the state of Minnesota by the murder of George Floyd, which happened in the city of Minneapolis during the survey period (May 25, 2020), and was followed by much social unrest.

2.2. Survey measures

The C-EAT survey was based on prior EAT surveys (Larson et al., 2013), with modifications made to focus recall on the past month of events related to the COVID-19 pandemic. The following survey

measures were included in the present investigation:

Variables assessed during the COVID-19 pandemic.

Influence of COVID-19 on stress or mood. Changes in stress or mood in response to the COVID-19 pandemic were assessed with a single-item question: “Have recent events related to COVID-19 influenced your stress or mood?” Response options were “no,” “yes, somewhat,” and “yes, very much.”

Participants who reported any influence of the COVID-19 pandemic on stress or mood were provided the following prompt: “Please comment on how events related to COVID-19 have influenced your stress or mood, including your overall level of stress and how you manage stress. What event(s) related to COVID-19 have been the most important to your stress and mood?” Participants were allowed to freely write-in their responses.

Influence of COVID-19 on substance use. Changes in substance use related to the COVID-19 pandemic were assessed with a single-item question: “Have recent events related to COVID-19 influenced your use of alcohol, cigarettes, or other drugs?” Response options were “no,” “yes, somewhat,” and “yes, very much.”

Participants who reported any influence of the COVID-19 pandemic on their substance use, were further provided the following prompt: “Please comment on how events related to COVID-19 have influenced your use of alcohol, cigarettes, or other drugs. What event(s) related to COVID-19 have most influenced your use of alcohol and drugs?” Participants were allowed to freely write-in their responses.

Depressive symptoms. A 6-item scale evaluated depressive symptoms over the past month (Kandel and Davies, 1982). The scale included items about the following symptoms: feeling too tired to do things, having trouble going to or staying asleep, feeling unhappy, sad or depressed, feeling hopeless about the future, feeling nervous or tense, and worrying too much about things. Participants were asked how much they have been bothered or troubled by each of the symptoms during the past month. Response options were “not at all,” “somewhat,” or “very much.” The average item value for each participant was multiplied by a factor of 10, resulting in scores that ranged from 10 to 30 with higher values indicating more severe depressive symptoms.

Perceived stress. Participants were asked to rate their level of stress over the past month on a scale from one to ten, with one being “not stressed at all” and ten being “very stressed.”

Stress management. Participants were asked to rate their ability to manage stress in the past month on a scale from one to ten, with one being “ineffective” and ten being “effective.”

Variables assessed before the COVID-19 pandemic.

Depressive symptoms, perceived stress, and stress management. The EAT 2018 survey assessed depressive symptoms, perceived stress, and stress management over the past 12 months using the same items discussed previously.

Sociodemographic variables.

The original school-based survey asked participants to report their structurally racialized groups and several indicators of SES. Given that young adults are likely to rely on their parents' socioeconomic resources and parental education has been shown to impact the financial status of young adults (Rauscher, 2016), SES was based on parental education. As in prior research in this study cohort, parental education was defined as the highest level of education of either parent, with missing or implausible values imputed or corrected using information on eligibility for public assistance, free or reduced-cost school meals, and parental employment status (Sherwood et al., 2009). Age and gender were based on responses to the EAT 2020 survey.

2.3. Statistical analysis

Analyses were conducted using IBM SPSS Statistics for Windows, Version 26.0 (IBM, Armonk, NY). Participants with missing outcome ($n = 20$) and sociodemographic ($n = 30$) data were excluded, resulting in an analytic sample size of 670 participants. To examine

sociodemographic factors associated with depressive symptoms, perceived stress, and stress management during the COVID-19 pandemic, a series of linear regression models were built. Separate models were run for each outcome (i.e., depressive symptoms, perceived stress, and stress management during the COVID-19 pandemic) and included main effects of age, gender (2 dummy coded variables, with men coded as the reference group), structurally racialized groups (5 dummy coded variables, with White coded as the reference group), and SES (4 dummy coded variables, with high SES coded as the reference group). All models were initially run with and without adjustment for pre-pandemic levels of the outcome variable (e.g., the model examining depressive symptoms during the COVID-19 pandemic was run with and without adjustment for pre-pandemic depressive symptoms reported during the EAT, 2018 survey). However, because adjustment for pre-pandemic levels of the outcome variables did not change the overall pattern of results, only the fully adjustment models are presented herein. Continuous predictors (i.e., age and pre-pandemic depressive symptoms, perceived stress, and stress management) were grand mean centered to facilitate interpretation. Interaction effects between key sociodemographic variables (e.g., race, gender, and SES) on each outcome were explored. However, because no significant interaction effects were found ($ps > 0.07$), only main effects are reported.

The open-ended comments examining changes to stress or mood and substance use in response to the COVID-19 pandemic were assessed using an inductive approach to thematic analysis previously described by Braun and Clarke (2006). All write-in comments were first read by two independent raters (RE and SJ) to gain an overall understanding of participant responses. After reading through the write-in comments several times, the raters separately identified preliminary codes to organize participant responses using Microsoft Excel. Codes between raters were then compared and broken into categories identifying major overarching themes. Preliminary thematic maps were constructed based on these categories. All write-in comments underwent additional evaluation by the raters and preliminary codes were further refined into final organizing themes and subthemes. Themes were not mutually exclusive, meaning that a participant's response could be included in multiple subthemes. After codes were finalized, both raters independently coded each comment using the final coding system. Inter-rater reliability coefficients were calculated and any discrepancy between raters was resolved through consensus. Specific quotations cited in this article were corrected for simple spelling and grammar mistakes.

3. Results

At the time of survey completion, 9% ($n = 60$) of the analytic sample reported living alone, 44% ($n = 295$) reported living with their parents, and 16% ($n = 105$) reported living with a spouse, while the remaining participants reported a different living situation ($n = 210$). Additional sample characteristics for the full analytic sample were calculated and appear in Table 1.

3.1. Influence of the COVID-19 pandemic on stress, mood, and substance use

Among the sample, 84% ($n = 561$) reported that the COVID-19 pandemic influenced their mood or stress to some degree, with nearly half ($n = 311$) indicating that their stress levels or mood had been impacted “very much.” Participants who reported that the COVID-19 pandemic impacted their stress or mood to some degree were more likely to be women compared to men ($\chi^2(1) = 4.76; p = 0.03$). No additional sociodemographic differences emerged ($ps > 0.12$). As expected, participants who reported that the COVID-19 pandemic impacted their stress or mood to some degree also reported higher levels of depressive symptoms ($t(668) = 10.42; p < 0.001$) and perceived stress ($t(668) = 12.19; p < 0.001$) and lower ability to manage stress ($t(668) = -3.12; p = 0.002$) compared to those who reported that the

Table 1
Sample characteristics (N = 670).

	Mean	SD
Age	25.19	1.93
Depressive symptoms		
Pre-pandemic	11.46	3.53
During COVID-19	11.90	3.48
Perceived stress		
Pre-pandemic	6.29	2.39
During COVID-19	5.67	2.42
Stress Management		
Pre-pandemic	6.25	2.32
During COVID-19	6.26	2.34
	n	%
Gender		
Men	242	36%
Women	418	62%
Other gender identity	10	2%
Racially structuralized groups		
White	206	31%
Black/African American	118	18%
Hispanic/Latinx	110	16%
Asian American	156	23%
Mixed or other race	80	12%
Socioeconomic status		
Low	217	32%
Low-middle	140	21%
Middle	111	17%
High-middle	125	19%
High	77	12%

COVID-19 pandemic had not impacted their stress or mood.

Meanwhile, 33% (n = 221) of participants reported that their substance use was impacted “somewhat” or “very much” by events related to the COVID-19 pandemic. Participants who reported that the COVID-19 pandemic impacted their substance use to some degree were more likely to identify as White ($\chi^2(1) = 16.85; p < 0.001$) and less likely to identify as Asian American ($\chi^2(1) = 14.31; p < 0.001$) compared to other structurally racialized groups. Such individuals were also more likely to report being of high-middle ($\chi^2(1) = 4.25; p = 0.04$) to high SES ($\chi^2(1) = 4.93; p = 0.03$). No additional sociodemographic differences emerged ($ps > 0.06$). Compared to participants who reported no impact of the COVID-19 pandemic on their substance use, those who did report some impact reported higher levels of depressive symptoms ($t(668) = 6.50; p < 0.001$) and perceived stress ($t(668) = 5.94; p < 0.001$) and lower ability to manage their stress levels ($t(668) = -3.89; p < 0.001$).

Factors associated with depressive symptoms, perceived stress, and stress management during the COVID-19 pandemic.

Results from the linear regression models examining factors associated with depressive symptoms, perceived stress, and stress management during the COVID-19 pandemic are presented in Table 2. As shown, women reported higher depressive symptoms ($\beta = 0.13, p < 0.001$), greater perceived stress ($\beta = 0.15, p < 0.001$), and lower perceived ability to manage stress ($\beta = -0.15, p < 0.001$) compared to men after controlling for other sociodemographic factors and pre-pandemic levels of each outcome. Besides, compared to individuals identifying as White, those identifying as Asian American reported lower depressive symptoms ($\beta = -0.09, p = 0.04$) and lower perceived stress ($\beta = -0.09, p = 0.03$) after controlling for other sociodemographic factors and pre-pandemic levels of each outcome. There were no significant effects of age or SES on depressive symptoms, perceived stress, or stress management during the COVID-19 pandemic.

In addition to sociodemographic factors, results also demonstrated that depressive symptoms, perceived stress, and stress management during the COVID-19 pandemic were strongly and positively associated with the level of each outcome before the pandemic. For example, for every one standard deviation increase in pre-pandemic depressive symptoms, there was nearly a half standard deviation increase in

Table 2
Multiple linear regression results predicting depressive symptoms, perceived stress, and stress management during the COVID-19 pandemic (N = 670).

	Outcomes during the COVID-19 pandemic					
	Depressive symptoms		Perceived stress		Stress management	
	β	p	β	p	β	p
Age	-0.04	0.22	-0.03	0.45	-0.05	0.18
Gender						
Men (ref)	-	-	-	-	-	-
Women	0.13	<0.001	0.15	<0.001	-0.15	<0.001
Other gender identity	0.04	0.23	0.04	0.25	-0.05	0.22
Racially structuralized groups						
White (ref)	-	-	-	-	-	-
Black/African American	-0.06	0.15	-0.01	0.82	-0.001	0.99
Hispanic/Latinx	-0.03	0.52	-0.02	0.69	0.05	0.30
Asian American	-0.09	0.04	-0.09	0.03	0.06	0.20
Mixed or other race	-0.01	0.90	-0.01	0.82	-0.01	0.87
Socioeconomic status						
Low	0.001	0.98	0.001	0.99	-0.04	0.54
Low-middle	-0.02	0.74	0.03	0.64	0.01	0.92
Middle	0.002	0.97	0.01	0.91	-0.05	0.35
High-middle	-0.002	0.97	0.01	0.90	0.01	0.87
High (ref)	-	-	-	-	-	-
Pre-pandemic depressive symptoms	0.45	<0.001	-	-	-	-
Pre-pandemic perceived stress	-	-	0.40	<0.001	-	-
Pre-pandemic stress management	-	-	-	-	0.28	<0.001

Note: Standardized beta coefficients are presented. Boldface indicates significance (p < 0.05).

depressive symptoms during COVID-19 ($\beta = 0.45, p < 0.001$), above and beyond sociodemographic effects.

Themes and subthemes identified among individuals reporting a change in stress levels or mood in response to the COVID-19 pandemic.

Among the 561 participants who reported that the COVID-19 pandemic influenced their mood or stress levels to some degree, 535 (95%) provided a write-in response detailing the specific impact of the COVID-19 pandemic on their stress levels or mood. Thematic analysis of the write-in responses revealed five major themes with underlying subthemes. Inter-rater reliability was acceptable ($\kappa = 0.88$). See Table 3 for additional quotations for each theme and associated subtheme.

Theme 1: Emotional Reactions to the COVID-19 Pandemic. A majority of participants (490/535) reported experiencing specific emotional reactions in response to the COVID-19 pandemic, among whom two subthemes emerged: 1) High emotional distress and 2) Low or improving emotional distress.

High emotional distress. The vast majority of participants reporting specific emotional reactions fell within the high emotional distress subtheme (419/490). These participants reported experiencing high and persistent emotional distress in response to the pandemic, characterized by increased stress, anxiety, worry, fear, depression, anger, irritability, and boredom. For example, one participant stated, “I find it harder to control my emotions, and I find it harder to lift myself out of a funk when I am feeling down. I feel more sad, irritable, and angry often. It used to be easier to shrug off small things. Small tasks make me feel much more stressed now” [26-year-old, White female].

Low or improving emotional distress. A much smaller proportion of participants (71/490) fell within the low or improving emotional

Table 3
Additional quotations from themes and subthemes related to changes in stress or mood in response to the COVID-19 pandemic.

Theme and subtheme	Quotation
<i>Emotional Reactions to the COVID-19 Pandemic</i>	
High emotional distress	<p>"I feel a notable amount of moodiness that feels very related to the virus. I am having sudden mood changes and more crankiness than usual. Lots of crying. It is particularly distressing because I don't have the words to explain it. I think I wish I could be a perfect pandemic person - calm, generous, lighthearted, cautious, etc. But instead I'm prickly and anxious and I feel like a burden to my roommates." [25-year-old, White female]</p> <p>"My stress level has been elevated and sometimes it affects my entire day. It will make me feel not motivated for anything. It will even make my brain foggy to the point where it makes me indecisive about my choices like what to make to eat or what to do for the day. It seems as though I make it hard for myself when I'm feeling stressed." [23-year-old, Hispanic/Latinx male]</p>
Low or improving emotional distress	<p>"COVID-19 has not stressed me at all actually. There are minor inconveniences, but safety is priority." [26-year-old, Asian American male]</p> <p>"When this first started I was very stressed and frustrated with all that was going on. Due to less social interaction and increased alone time, my stress level has decreased." [27-year-old, Hispanic/Latinx female]</p>
<i>Stress Related to the Direct Impact of the COVID-19 Pandemic</i>	
Fear of self or loved ones contracting COVID-19	<p>"Everyday I am afraid that I have COVID-19 or that my siblings do. I am in contact with people still at work, and then I go grocery shopping, and my parents bring who knows what home every time they go out. I don't feel safe at home nor at work. I am afraid I'll bring COVID-19 to my siblings or my co-workers. Every cough, every itch in my throat, every short breath I have, every headache and migraine. I am afraid." [25-year-old, Asian American female]</p>
Fear of global, societal, and political impact of COVID-19	<p>"I am worried about the long-term effects on the economy. I am about to separate from the military and leaving that kind of security for the unknown is stress-inducing." [22-year-old, White male]</p> <p>"It's stressful to think about the uncertainty and the unknown effects COVID will have on society." [24-year-old, Black/African American female]</p> <p>"[I'm] worried about Racist people because I'm Asian. It's so scary to go anywhere now. Anywhere [I] go is no longer a happy feeling or feels safe. Even going to the grocery store makes me scared." [22-year-old, Asian American female]</p> <p>"Hearing about public groups fighting against and politicizing business closures and social distancing is really demoralizing." [25-year-old, White female]</p>
<i>Stress Related to Connectedness during the COVID-19 Pandemic</i>	
Social isolation and loss of social activities	<p>"Being an extroverted person makes being home alone very difficult." [26-year-old, White female]</p> <p>"[I'm] stressed out [because] of nothing to do besides work and video games. [I] can't go out and do activities with friends." [22-year-old, White male]</p> <p>"It's just been hard being cooped in the house because I love being up and doing things. But I've been staying indoors and it sucks." [22-year-old, Black/African American female]</p>
Increased interpersonal strain	<p>"Not leaving the house has been a strain. Everyone is always home, and having meetings and I'm taking classes, so it's nearly impossible</p>

Table 3 (continued)

Theme and subtheme	Quotation
	<p>to have a quiet moment alone. I constantly feel socially drained and in need of alone time." [23-year-old, Asian American female]</p> <p>"It's stressful being in a house with 4 kids that are 6 and under and 2 being twins. It's hard to do schoolwork for the oldest when there's 3 others needing attention." [25-year-old, White female]</p>
Loss of routine and sense of normalcy	<p>"I've noticed that I've been more stressed lately than I normally am. This could be due to lack of a daily work routine and having too much time on my hands. I ... try to remember that this situation is temporary and life will eventually get back to some normalcy." [23-year-old, White male]</p> <p>"I get frustrated because there isn't face to face school on campus and ... I'm not getting the college experience." [22-year-old, Black/African American female]</p>
<i>Economic Stress Related to the COVID-19 Pandemic</i>	
	<p>"I've been more stressed out lately because of losing my job and not knowing if I can afford to eat from day to day" [28-year-old, White male]</p> <p>"I feel 100% overwhelmed and stressed by the impacts of COVID. I have not been able to pay many bills, I cannot work because I am a single mother who now is home with my child all day, everyday." [26-year-old, White female]</p> <p>"At first it was stressful that we couldn't go out. But now the stress is more on our Financial Situation. Only my father is working compared to 4 of us that used to work before COVID." [27-year-old, Hispanic/Latinx female]</p>
<i>Strategies for Managing Stress during the COVID-19 Pandemic</i>	
Adaptive coping strategies	<p>"I'm afraid of a lot of things happening. But I keep myself occupied with music and video games. I've been writing more now and trying to focus on fiction rather than reality. I go on Animal Crossing to tend to my flowers and catch fish. I go on TikTok and laugh with my younger sisters over the latest trends. I call to video chat with my baby nieces and nephew. I Zoom in to talk to friends in the city across the river or in NYC and South Korea. I go to work and rant to my co-workers about things that don't matter. I try and breathe, try and take everything slow. The only real way to survive this time is to remember to be the you that you were before this moment and the you that you wanted to be if this hadn't happened." [25-year-old, Asian American female]</p> <p>"I try to create a to-do list daily so I can feel like I can/will have a productive day. When I do the to-do lists, my mood improves, and I feel more accomplished." [23-year-old, Black/African American female]</p>
Maladaptive coping strategies	<p>"I find myself increasing alcohol consumption out of boredom and to soothe anxiety. I also turn to entertainment to take my mind off it." [28-year-old, White female]</p> <p>"I have trouble falling asleep without the help of chemicals." [23-year-old male of other racial identity]</p> <p>"Sleep has been my main coping skill" [27-year-old, Black/African American female]</p>
Loss of coping strategies or not coping	<p>"I have not been managing my stress because I do not know how to effectively manage it." [21-year-old, Asian American female]</p> <p>"I haven't been able to make an appointment to see my therapist, so I haven't been able to get back on my antidepressants." [22-year-old, White female]</p>

distress subtheme. These participants reported two distinct types of reactions to the pandemic characterized by either low levels of emotional distress or an acute increase in emotional distress during the early stages of the stay-at-home order followed by a gradual improvement.

Concerning the latter, one participant stated, “Initially, the stay at home order in my area was stressful, I have been stuck at home for months now. I was experiencing heightened degrees of stress and anxiety for a while as well as loneliness. But as time has gone on, I have gotten used to this situation and have found ways to deal with my stress” [23-year-old, Hispanic/Latinx female].

Theme 2: Stress Related to the Direct Impact of the COVID-19 Pandemic. Over one-third (175/535) of participants identified specific stressors related to the direct impact of the COVID-19 pandemic, which fell into two subthemes: 1) Fear of self or loved ones contracting COVID-19 and 2) Fear of the global, societal, and political impact of COVID-19.

Fear of self or loved ones contracting COVID-19. A majority of participants who identified stressors related to the direct impact of the COVID-19 pandemic reported feeling fearful of infection and transmission of the virus (131/175). Participants endorsed specific fears of becoming infected with COVID-19 or unknowingly spreading the virus to their family or friends. A number of participants cited particular concern about their older family members or young children contracting the virus. For example, one participant said, “I am stressed with the idea of my lower immune system putting me at risk, but I am more concerned with my older family members who are misinformed on the matter and are putting themselves at risk” [27-year-old, White male]. Participants also reported increased monitoring of symptoms resembling those of COVID-19 (e.g., sore throat, coughing) and feeling hypervigilant when going out in public due to fear of contracting the virus.

Fear of the global, societal, and political impact of COVID-19. Additional participants who fell within this major theme (73/175) reported a range of fears regarding the larger impact of the COVID-19 pandemic on the world, society, and politics. Participants endorsed feelings of unease regarding the constant negative news coverage of the pandemic, with several participants expressing specific concern about the state of the economy and current political leadership in the U.S. For example, one participant said, “The Trump administration greatly impacts my stress with inconstant information related to COVID-19” [23-year-old, Asian American female]. Some participants also reported feeling worried about the increase in racial attacks directed towards Asian Americans following the initial discovery of COVID-19 in China. One participant stated, “Since we aren’t supposed to leave anywhere, and I am Asian, I am afraid to leave my home and be attacked. I was verbally attacked twice. So too afraid to leave anywhere with my kids” [27-year-old, Asian American female].

Theme 3: Stress Related to Connectedness during the COVID-19 Pandemic. Nearly half (256/535) of participants identified stressors related to the impact of the stay-at-home orders and social distancing measures on their interpersonal connectedness, with three subthemes emerging: 1) social isolation and loss of social activities; 2) increased interpersonal strain; and 3) loss of routine and sense of normalcy.

Social isolation and loss of social activities. Just over half of participants falling within this major theme identified social isolation and loss of social activities to be among their primary stressors during the COVID-19 pandemic (138/256). Participants within this subtheme reported feeling lonely and isolated due to their inability to physically interact with their friends and family. Some participants also reported feeling trapped inside their homes, with others noting that the loss of their typical social activities prevented them from coping or socializing in the ways they usually would and resulted in feelings of boredom, frustration, and discontent. One participant described the following: “I’m VERY STRESSED because I am not able to socialize the way I want to. I’m not able to work out or hang out with friends. I feel locked [up], and like I can’t do anything and that my life is on hold. [This is] why my mood is always so negative now” [25-year-old, Hispanic/Latinx female].

Increased interpersonal strain. A smaller proportion of participants reported experiencing increased interpersonal strain and caretaking demands as a result of the COVID-19 pandemic (45/256). Many of these participants reported that being at home for sustained periods with their family, partners, or roommates was resulting in increased interpersonal

tension and conflict. For example, one participant said, “Staying home all day with my spouse has caused us to be more irritable and pick fights for silly things” [25-year-old, Hispanic/Latinx female]. Several participants additionally reported that the increased childcare demands resulting from school and daycare closures were particularly stressful. One participant stated, “I live with two elementary school kids who are now home 24/7, which is making us all crazy. I think childcare is one of the bigger problems with this pandemic” [26-year-old, White male].

Loss of routine and sense of normalcy. Half of the participants further reported feeling a loss of routine and sense of normalcy as a result of the COVID-19 pandemic (128/256). Participants described significant disruptions to their sleep, eating, exercise, schooling, and work routines. One participant stated, “The new balance of working from home has been stressful. I already struggle to keep work separate from home. Now I need to work extra hard to have the distinction between the two” [25-year-old, White female]. Others described a general sense of disruption to their lives and uncertainty about when their lives will return to normal.

Theme 4: Economic Stress Related to the COVID-19 Pandemic. Economic stress stemming from job and financial disruptions during the COVID-19 pandemic were identified as stressors among 19% of participants (104/535). Participants described a range of concerns, including uncertainty about the job market, current unemployment, fear of getting fired or furloughed, loss of income, and concern about paying bills or affording basic needs. For example, one participant said, “Most of my stress comes from not knowing how long our unemployment benefits will last and how uncertain the job market will be in the future, or if I will be able to work after this is over” [21-year-old, White female].

Theme 5: Strategies for Managing Stress during the COVID-19 Pandemic. Nearly one-third of participants (160/535) identified specific strategies for how they are managing stress during the COVID-19 pandemic. Among those reporting specific stress management strategies, three subthemes emerged: 1) Adaptive coping strategies; 2) Maladaptive coping strategies; and 3) Loss of coping strategies or not coping.

Adaptive coping strategies. A majority of participants reported engaging in adaptive coping strategies to manage their stress during the COVID-19 pandemic (121/160). These strategies included increased exercise and physical activity, cooking meals, developing routines, engaging in self-care and relaxation, seeking social support, practicing cognitive reframing and positive self-talk, using recommended safety measures to guard against COVID-19, attending therapy, minimizing social media use, and participating in hobbies. For example, one participant stated, “I am usually good at managing my stress so when I realize I am stressed, I set time aside for myself to relax and remind myself that this time is my time or I try to solve or complete what is stressing me out whether that is homework or housework” [21-year-old, Asian American female].

Maladaptive coping strategies. Several participants reported engaging in maladaptive or avoidant coping strategies to manage their stress during the COVID-19 pandemic (21/160). These strategies included increased substance use, sleeping more to pass time, and stress eating. For example, one participant said, “My anxiety, depression, and stress levels are at an all-time high. I have been eating and drinking to deal with the stress and depression” [23-year-old, White female].

Loss of coping strategies or not coping. The remaining participants reported that they were unsure of how to cope with their stress levels because the COVID-19 pandemic is preventing them from engaging in their typical coping strategies (38/160). Other participants stated that they simply are not coping with their stress levels during the COVID-19 pandemic because they are unsure of the most effective way to do so. For example, one participant said, “I think I’ve lost or forgotten a lot of my stress management skills” [23-year-old, Black/African American female].

Themes and subthemes identified among individuals reporting a change in substance use in response to the COVID-19 pandemic.

Among the 221 participants who reported that the COVID-19

pandemic influenced their substance use to some degree, 214 (97%) provided a write-in response detailing the specific impact of the COVID-19 pandemic on their substance use. Thematic analysis of the write-in responses revealed two main themes with several underlying subthemes. Inter-rater reliability across themes was excellent ($\kappa = 0.92$). See Table 4 for additional quotations for each theme and associated subtheme.

Theme 1: Changes in Substance Use during the COVID-19 Pandemic. A majority of participants (185/214) detailed specific changes to their patterns of substance use during the COVID-19 pandemic, with two distinct subthemes emerging: 1) Increased substance use and 2) Decreased substance use.

Increased substance use. The vast majority of participants who indicated that their substance use changed following the COVID-19 pandemic reported increased use (146/185), particularly with regard to alcohol and, to a lesser extent, marijuana and tobacco products. Although some participants reported slight upticks in their substance use, others noted significant increases in their use. For example, one participant stated, “My drinking has increased. I was already a heavy drinker, but now I get drunk 3 nights a week” [23-year-old male of other racial identity].

Decreased substance use. A smaller proportion of participants indicated that the COVID-19 pandemic had led to a general reduction in or complete cessation of their substance use, largely due to reduced social activities or not wanting to go to the liquor store (39/185). Others reported that they had an initial increase in their substance use during the initial stages of the pandemic followed by a gradual reduction. For example, one participant described the following: “Being quarantined increased my use of alcohol and drugs at first but has now lessened it since I haven’t been seeing many friends or going out” [24-year-old, White

female].

Theme 2: Motivations for Substance Use during the COVID-19 Pandemic. Nearly half of participants (101/214) identified motivations for using substances during the COVID-19 pandemic. Among those reporting specific motivations for substance use, two subthemes emerged: 1) Using substances because of boredom and more time at home and 2) Using substances for stress management.

Using substances because of boredom and more time at home. A majority of participants reporting their motivations for substance use identified boredom, more time, and having nothing else to do as being significant motivators for using (68/101). For example, one participant said, “Because I spend more time at home, I am drinking more alcohol. There are not much other activities to have” [25-year-old, Hispanic/Latinx male].

Using substances for stress management. Over half of participants reported that a primary motivation for using substances was to manage stress (53/101). One participant said, “I have been so scared about everything going on I have been using coping mechanisms such as eating, drinking and smoking to help with the anxiety and stress. I now start drinking as soon as I wake up because I’m so scared” [23-year-old, White female].

4. Discussion

The present study aimed to identify young adults at greatest risk for heightened psychological distress in response to the U.S. outbreak of COVID-19 and to further understand how the pandemic has impacted their stress, mood, and substance use through analysis of quantitative and qualitative survey data from a population-based sample of young adults in the greater Minneapolis-St. Paul area. The majority of young adults in this sample reported that the COVID-19 pandemic had some impact on their mood or stress levels and over one-third indicated that their pattern of substance use had changed in response to the pandemic. Results showed gender, race, and pre-pandemic levels of depressive symptoms, perceived stress, and stress management ability to be particularly meaningful predictors of psychological adjustment during the pandemic. Themes derived from the qualitative survey data further revealed unique perspectives on and reactions to the COVID-19 pandemic among young adults concerning changes in their stress, mood, and substance use.

The present findings document that women and individuals with poorer psychological adjustment before the pandemic reported heightened psychological distress during the COVID-19 outbreak. Young adult women were specifically shown to report higher levels of depressive symptoms and perceived stress and a lower ability to manage stress in response to the COVID-19 pandemic when compared to young adult men. This gendered difference is in line with previous reports (Rodríguez-Rey et al., 2020) and likely stems from a combination of factors. For example, women have reported greater increases in unpaid labor (e.g., childcare and housework) in response to the pandemic compared to men, which have contributed to higher personal and financial stress (Farré et al., 2020) and poorer psychological wellbeing (Andrew et al., 2020; Xue and McMunn, 2020). In addition, pre-pandemic levels of depressive symptoms, perceived stress, and stress management ability were found to be among the strongest predictors of these outcomes during the pandemic. These findings are in line with others (Asmundson et al., 2020) and indicate that the COVID-19 pandemic has had a particularly adverse impact on the psychological functioning of those with preexisting mental health problems.

Our study further contributes to the present literature by documenting that White individuals reported higher levels of depression and perceived stress than did Asian American individuals in response to the COVID-19 pandemic. These findings run counter to a previous study documenting higher rates of psychological distress in response to the COVID-19 pandemic among individuals identifying as Asian compared to other races (Fitzpatrick et al., 2020) and contribute to accumulating evidence documenting inconsistent differences in mental health

Table 4

Additional quotations from themes and subthemes related to changes in substance use in response to the COVID-19 pandemic.

Theme and subtheme	Quotation
<i>Changes in Substance Use during the COVID-19 Pandemic</i>	
Increased Substance use	“I have drank a little bit more than I had been before isolation. Before I would have 2–4 a week. Now I’ll have maybe 4–5.” [22-year-old, Hispanic/Latinx Male] “I have always loved an occasional drink here and there, but I find I’m drinking almost every night and drinking twice as much each time.” [26-year-old, White female] “I’ve been vaping a lot more.” [24-year-old, White Female]
Decreased substance use	“I don’t drink, but I am a smoker. I have actually cut back on smoking.” [26-year-old, White Female] “I’ve stopped drinking alcohol. I normally drink socially, so bars and restaurants closed has stopped the majority of my drinking. Because of that, and because I’m so much less active now, I’ve decided to just not drink at all.” [23-year-old, Asian American female]
<i>Motivations for Substance Use during the COVID-19 Pandemic</i>	
Using substances because of boredom and more time at home	“If I’m staying home all day it’s hard not to find myself drinking alcohol or smoking to make things a little less boring.” [23-year-old, Hispanic/Latinx Male] “Since I have more leisure time, I have consumed more wine recently than I have in years.” [24-year-old, Black female]
Using substances for stress management	I have been drinking almost every day, and smoking weed more often. This is because I am anxious and stressed. [24-year-old, White Female] “It’s easy to drink alcohol when the [liquor] stores are one of the only places to shop. Also, wine is one of the best stress relievers.” [26-year-old, White Female]

outcomes across structurally racialized groups during the pandemic (Lee, 2020; Lee et al., 2020; Marroquín et al., 2020). Unlike previous reports (Pierce et al., 2020), this study also did not find differences in psychological distress across varied levels of SES. Because this study was not specifically designed to identify racial or socioeconomic differences in psychological reactions to the COVID-19 pandemic, it will be imperative for future research to more systematically investigate whether, how, and why the COVID-19 pandemic differentially impacts individuals belonging to different racial and socioeconomic groups.

Results from the thematic analysis of the qualitative survey data revealed unique insight into the experiences and perspectives of young adults during the COVID-19 pandemic concerning changes in stress, mood, and substance use. Although some young adults described relatively low levels of emotional distress in response to the pandemic, the majority reported high and persistent emotional distress, characterized by increased stress, anxiety, worry, fear, depression, anger, irritability, and boredom. The most frequently reported stressors were those related to the direct impact of COVID-19 as well as changes to social connectedness in response to the pandemic. Participants described feeling fearful of themselves or their loved ones contracting the virus and expressed concern regarding the larger impact of the pandemic on society. Many participants also reported a loss of social connectedness as a result of the social distancing measures and expressed discontent regarding their reduced sense of normalcy and inability to engage in their usual social activities. Other participants described feeling interpersonally overwhelmed due to increased childcare demands and feeling “trapped” in their homes with other family members and housemates, leading to heightened tension and conflict. Many participants further reported experiencing economic stress stemming from job and financial disruptions during the COVID-19 pandemic. These participants expressed a range of concerns, including uncertainty about the job market, current unemployment, fear of getting fired or furloughed, and concern about paying bills or affording basic needs. Although several government assistance programs have been implemented in the U.S. to offset the economic impact of the COVID-19 pandemic (e.g., stimulus checks, unemployment benefits, hazard pay), national data indicate that young adults continue to report high rates of financial hardship as a result of the pandemic (U.S. Census Bureau, 2020). Recent findings from this cohort further demonstrate a high prevalence of food insecurity during the COVID-19 pandemic (Larson et al., 2020), indicating that young adults are experiencing high rates of economic burden during the ongoing crisis and may require additional financial assistance and relief funds.

Importantly, a large proportion of young adults reported engaging in adaptive coping strategies, such as increased exercise and physical activity, practicing cognitive reframing and positive self-talk, minimizing social media use, and participating in hobbies, to manage their pandemic-related emotional distress. However, others indicated that they were unsure of how to manage their emotional distress because they had lost the ability to engage in their typical coping strategies because of the pandemic or were attempting to alleviate their distress by turning to maladaptive coping strategies, such as sleep and substance use.

Among the young adults who reported some change in their pattern of substance use in response to the pandemic, the majority described increases in their use, particularly concerning alcohol and, to a lesser extent, marijuana and tobacco products. Although some participants reported slight upticks in their substance use, others noted significant increases in their use, characterized by elevations in both the frequency and quantity of substance use. Among those who increased their substance use, the majority reported doing so as a means to regulate their emotional distress or because they were spending more time at home with little else to do for entertainment. These findings are consistent with theories of substance use disorders (Kober, 2014; Wilcox et al., 2016), which state that substances are often used as a means to quickly and effectively, albeit maladaptively, regulate emotional distress.

Indeed, Lechner et al. (2020) found that young adult college students with higher levels of depression and anxiety reported greater increases in alcohol use over time as compared to those with lower levels of distress during the COVID-19 pandemic. These findings thus identify substance use as an important target for prevention and intervention efforts implemented among young adults and further suggest a need for broad public health messaging about alternative and more adaptive coping strategies to substance use.

Taken together, the present study indicates that young adults endorse high levels of emotional distress in response to the COVID-19 pandemic and describe a variety of stressors contributing to their distress. These findings build upon those of others by documenting poor psychological adjustment among young adults in response to the pandemic (Huang and Zhao, 2020; Pierce et al., 2020; Rettie and Daniels, 2020; Rodríguez-Rey et al., 2020; Tull et al., 2020; Wang et al., 2020) and indicate that this population may be especially vulnerable to the stressors incurred from the ongoing crisis (Liu et al., 2020; Luchetti et al., 2020; Qiu et al., 2020; Shanahan et al., 2020). Given emerging findings suggesting that emotional reactions to the initial phase of the pandemic may remain relatively stable (Wang et al., 2020), there is an urgent need to develop effective, scalable, and rapidly deployable mental health interventions that target the stressors commonly experienced among young adults to improve their psychological wellbeing. Despite high levels of reported engagement in adaptive coping strategies in this sample, emotional distress remained elevated and a large number of young adults reported increased substance use, indicating that young adults may benefit from additional resources focused on learning more effective skills to adapt to the chronic nature of the stress associated with the ongoing pandemic (Yang et al., 2020). Internet- and mobile-based interventions have been shown to be efficacious for the treatment of depression (Andersson et al., 2019; Josephine et al., 2017), anxiety (Domhardt et al., 2019), and substance use (Gulliver et al., 2015) and are well-suited to the current need to engage in virtual healthcare approaches. Increasing awareness of and access to such resources could be especially beneficial among young adults, particularly women, White individuals, and those with preexisting mental health problems.

4.1. Limitations

These findings should be considered in the context of certain limitations. First, our sample was comprised of young adults who predominantly resided in the state of Minnesota. Thus, our findings may not extend to people of other ages or those living in other areas. Second, this study conducted a thematic analysis on write-in responses to open-ended survey questions, which limits the richness of our data compared to what could be obtained through qualitative interviews. As such, future qualitative research is needed to more fully understand how the mental health of young adults has been impacted by the COVID-19 pandemic. Third, although we assessed depressive symptoms, perceived stress, and perceived ability to manage stress prior to and during the pandemic, we were unable to assess changes in these variables due differences in the timeframes assessed (i.e., these variables were assessed across the past 12-months prior to the pandemic and across the past month during the pandemic). Because of this, we are not able to comment on the magnitude of change that occurred in depressive symptoms, perceived stress, and perceived ability to manage stress in response to the pandemic. Despite these limitations, the present study also had several notable strengths, including a diverse sample of young adults, the ability to use a rapid response survey with participants to gather data on pressing and timely issues, longitudinal assessment of psychological adjustment prior to and during the COVID-19 pandemic, and the use of qualitative survey data to contextualize our quantitative findings and begin to understand how young adults have personally perceived changes to their stress, mood, and substance use in response to the outbreak of COVID-19.

5. Conclusions

This study identifies unique perspectives and experiences of young adults in response to the COVID-19 pandemic. This study identifies young adults as an important population in need of targeted resources to promote more effective strategies to cope with the ongoing stressors associated with the pandemic. These findings can be used to inform intervention and policy efforts aimed at improving the health and wellbeing of young adults during the COVID-19 pandemic. For example, these findings highlight a need for additional government assistance programs and relief funds to help offset the economic burden of the COVID-19 pandemic on young adults and further underscore the potential for affordable internet- and mobile-based interventions to be broadly implemented among young adults to improve their psychological adjustment to the pandemic by learning more adaptive coping strategies and reducing reliance on substance use.

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Declaration of competing interest

None.

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