Suicide Risk During COVID-19: Correlates of Peri-pandemic Suicidal Ideation Controlling for Pre-pandemic Ideation

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Abstract

Suicide is a public health concern which warrants considerable attention, especially with the onset of the COVID-19 pandemic. The current study sought to examine the relationship between behavioral, psychological, and economic impacts of COVID-19 on suicidal ideation severity in a sample of 90 undergraduate students who completed a comprehensive survey on mental health in January 2020 and were re-assessed in April, June, and July of 2020. Multiple regression analyses showed that changes in experience of loneliness, loneliness due to social distancing, pandemic-related concerns, COVID contagion anxiety, and quarantining alone positively and significantly correlated with peri-pandemic suicidal ideation severity after accounting for pre-pandemic suicidal ideation and sexual orientation, while time spent talking to romantic partner and time spent talking to friends and family were negatively correlated. Findings provide insights into the psychological and behavioral effects of social distancing measures and the pandemic, but further research is needed to generalize findings.

Keywords COVID-19 · Pandemic · Suicide Risk · Suicidal Ideation · Suicide

Introduction

With the introduction of the novel coronavirus disease 2019 (COVID-19) that brought on a global health crisis at the start of 2020, local, state, and federal governments had to implement serious public health measures to slow the spread of the virus. While these measures helped mitigate contagion, they also had potential inadvertent negative secondary outcomes that could increase the risk for suicide

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(Reger et al., 2020). Despite the overall steady decrease in both youth suicide rates and overall suicide rates in many economically developed countries (Organization for Economic Co-operation and Development [OECD]; Roh et al., 2018), suicide remains a significant public health problem—including for young adults in the USA. Since 2007, suicide rates of those aged 10 to 24 have risen every year, becoming the second leading cause of death for this demographic by 2017 (Curtin & Heron, 2019). While overall suicide rates have seen a decrease in 2019 and 2020, it is still one of the leading causes of death, maintaining its status as a major public health issue (Ahmad & Anderson, 2021). Given the rate of suicide-related outcomes in US young adults, this cohort may be particularly vulnerable to the following negative secondary outcomes of public health measures and the pandemic at large.

Social Disconnection and Isolation

One of the main public health measures implemented both in the USA and globally was social distancing combined with stay-at-home orders. While this increased public safety, it also left individuals at risk of both objective feelings of loneliness through physical distance and isolation and subjective feelings of loneliness through potential emotional distance from social support networks and social disconnection. Theoretically, social disconnection and isolation could confer risk for suicide in young adults through increases in thwarted belongingness (i.e., perceived rejection of innate human need to belong) and perceived burdensomeness (i.e., belief one is a burden on others), which are constructs outlined in the Interpersonal Theory of Suicide (IPTS; Joiner, 2007). Empirically, social disconnection and isolation have been both directly linked to increased suicide-related outcomes, such as suicidal ideation and suicide attempts (Calati et al., 2019; Chu et al., 2017), and indirectly linked through an increase in depressive symptoms (Matthews et al., 2016). Studies have repeatedly indicated that depressive symptoms confer risk for suicidal ideation, suicide attempts, and suicide deaths (Angst et al., 1999; Ribeiro et al., 2018; Stravynski & Boyer, 2001), with young adults experiencing higher rates of depression symptoms compared to 2019 (Twenge & Joiner, 2020b). Social disconnection and isolation, compounded with the increasing rates of depressive symptoms among young adults, make an increase in suicide-related outcomes a possibility, which is further supported theoretically through the lens of IPTS.

Anxiety

Recently published studies have indicated that young adults have experienced an increase in symptoms of anxiety (Ahmed et al., 2020) and higher feelings of nervousness and restlessness compared to both 2018 (Twenge & Joiner, 2020a) and 2019 (Twenge & Joiner, 2020b). With the onset of the pandemic, fears of infection related to COVID-19 have become prevalent (Cao et al., 2020; Tull et al., 2020; Wang et al., 2020). This is notable due to the risk anxiety symptoms and diagnoses of anxiety disorders pose when it comes to suicidal ideation (Balázs et al., 2013; Sareen et al., 2005).

Economic Disruption

Stay-at-home orders have had a deleterious impact on the national economy, including an unprecedented surge in Americans claiming loss of employment (International Labor Organization, 2020). Many young adults who support themselves may now be unemployed, and those who rely on their families for financial support may experience a stall in finances due to unemployment of the supporter. These economic challenges may have an even greater impact on those graduating and joining the work force. Entering the job market during a recession decreases the likelihood of immediate employment, indicates lower wages for those who are already employed (Kahn, 2010; Rothstein, 2019), and is correlated with higher mortality rates among younger populations due drug overdose and suicide (Case & Deaton, 2020; Schwandt & Von Wachter, 2019). Therefore, the economic impacts of COVID-19 may also serve as an avenue for negative mental health outcomes in young adults.

Coping Behaviors

Although concern for negative secondary consequences in response to COVID-19 remains, a variety of coping strategies have been observed that may mitigate suicide risk during the pandemic. In response to combating social disconnection and isolation, many may have increased their social engagement via virtual "hangout" sessions, phone conversations with their social network, and social media platform use. When it comes to risk of contracting the virus, engaging in recommended safety precautions such as hand washing, hand sanitizer use, and wearing a mask may provide relief of COVID-19-related anxiety in some individuals. Consistent with models that indicate higher perceived control leads to reductions in anxiety response (Barlow, 2004; Wadsworth & Hayes-Skelton, 2020), engagement in safety precaution behaviors may serve to increase the perception of control and protection from COVID-19, consequently decreasing anxiety levels and, thus, decreasing the risk for suicide (Goldberg et al., 2020; Szczesniak et al., 2020).

The Current Study

Empirical research on the potential behavioral and psychological byproducts of COVID-19 as it relates to suicide risk, particularly increases in suicide risk independent from the exacerbation of preexisting, pre-pandemic suicidal ideation is needed. Therefore, in the current study, we analyzed the relationship between various behavioral, economic, and psychological correlates and the severity of suicidal ideation after the declaration of a global pandemic within a sample of undergraduate students, controlling for pre-pandemic suicidal ideation. We hypothesized that severity of suicidal ideation would be significantly and positively associated with behavioral, economic, and psychological consequences of the pandemic above and beyond pre-pandemic suicidal ideation. Therefore, those experiencing more severe suicidal ideation would report higher levels of loneliness, depressive symptoms,

financial difficulties, alcohol consumption and substance usage, and anxiety symptoms, both pandemic-related and generalized. Additionally, we hypothesized that coping mechanisms, such as using technology to maintain communication with family, friends, and romantic partners, and engagement in preventative behaviors, such as mask-wearing and hand sanitizer use, would be significantly and negatively correlated with severity of suicidal ideation. We hypothesized that this relationship would also be significant and independent of pre-pandemic suicidal ideation.

Furthermore, we included an exploratory analysis of the relationship between suicidal ideation severity and firearm purchase following the COVID-19 pandemic. Following the implementation of public health measures in the USA at the start of the pandemic, firearm purchases increased significantly as people experienced a heightened sense of uneasiness and greater concern for their safety. Although studies have demonstrated that ownership and willingness to purchase a firearm could be indicative of increased risk for suicide (Edwards et al., 2018), others suggest spikes in firearm sales during uncertain times reflect fear of victimization, and do not necessarily relate to suicide risk (Depetris-Chauvin, 2015; Hauser & Kleck, 2013). Thus, firearm ownership and willingness to purchase were analyzed without a priori hypotheses as their relationship with suicidality in the context of the COVID-19 pandemic was challenging to discern.

Methods

Participants and Procedures

Participants were undergraduate students enrolled in a psychology course during the Spring and Summer semesters at a university in the southeastern US. At the start of each semester, the psychology department administers a voluntary, online screening survey used to recruit participants into research studies (in 2020, administered from January 8 to January 24). To assess the general impact of COVID-19, the original screening survey, along with new COVID-19-related questions, were re-administered and completed at the end of the spring semester (April 14 to April 25 in 2020) and during the summer semesters (June 9 to June 19 and June 24 to July 10 in 2020). The option of participating was announced by instructors of undergraduate psychology courses through Canvas, an online learning platform. All surveys were administered through the secure online platform Qualtrics, where consent was also obtained prior to participation. Participants received either course credit or extra credit for completion. All procedures were approved by the university's institutional review board.

A total of 670 participants completed the original mass screening survey administered in January (Time 1), 188 participants completed the re-administered screening survey in April (Time 2a), and 208 participants completed the survey in June and July (Time 2b). Of the 188 that completed the survey in April, 79 completed the Depressive Symptom Severity-Suicidality Subscale (DSI-SS) at both timepoints. Of the 208 that completed the survey in the summer, 11 completed the DSI-SS at Time 1 and Time 2b. Altogether, the total sample was 90 participants. The significant

reduction in sample size is primarily due to a combination of factors: 1) all current students were invited to complete the re-administered screening survey, including those who had not completed the survey at Time 1; and 2) a large proportion of the participants at both timepoints were missing suicidal ideation severity data as, for safety purposes (Michaels et al., 2015), the DSI-SS items were only administered if the participant provided a phone number and the survey was initiated during hours when an over-the-phone suicide risk assessment would be available (8:00 AM to 10:00PM EST). The demographics of our final sample ($n=90$) are presented in Table 1 in supplementary materials.

Demographic differences were examined across the 90 participants and the remainder of participants that completed the survey at Time 1, Time 2a, and Time 2b. Overall, our sample was representative of the overall sample collected throughout all timepoints.[1]

Measures

Depressive Symptom Severity-Suicidality Subscale (DSI-SS) The DSI-SS (Joiner et al., 2002) assesses suicidal ideation severity over the past two weeks and consists of four questions that are scored on a 0 to 3 Likert scale, with higher scores indicating greater severity of suicidal ideation—the highest score one can get is 12. The questions were modified in this survey to assess suicidal thoughts that occurred over the past month. Within this sample, the DSI-SS demonstrated good internal consistency ($\alpha=0.87$ at Time 1 and $\alpha=0.89$ at Time 2). A sum score of the DSI-SS items was used to quantify suicidal ideation severity over the past month.

Major Depressive Disorder (MDD) Symptom Severity Eight questions assessed the self-reported severity of eight of the nine MDD symptoms (all except suicidality) during the past two weeks as measured by the duration of each symptom. Symptoms that were assessed included anhedonia, feeling depressed, sleep disturbance, fatigue, appetite change, feelings of worthlessness or excessive guilt, diminished ability to concentrate, and psychomotor agitation or retardation. Each item was rated on a 0 to 3 Likert scale, which ranged from 0 ("Not at all") to 3 ("Nearly every day"). A total score was calculated and used as a measure of Major Depressive Disorder symptom severity. The internal consistency of this measure within this sample was good ($\alpha=0.87$) and was combined into a sum score for analyses.

Penn State Worry Questionnaire (PSWQ) Three questions from this self-report measure were administered to assess generalized anxiety symptoms. Participants rated on a scale from 1 ("Not at all") to 5 ("Very") the extent to which they felt each of the three statements presented was most typical for them. The internal consistency of

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[1] For more information on demographic differences, please see supplemental materials.

these items was excellent within this sample (α = 0.92) and was combined into a sum score for analyses.

Impact of COVID-19 A total of 54 items were used to assess the impact of COVID-19 which were categorized as follows: 1) Social disconnection and isolation, 2) Financial impact, 3) Pandemic-related concerns, 4) COVID-19 contagion anxiety, 5) Preventative behaviors, 6) Social distancing/quarantine-related items, and 6) Coping behaviors.[2] As described below, we formed sum scores of the items within the categories in which reliability statistics were at least adequate; if not, the items were examined individually.

Social Disconnection and Isolation To assess the impact of COVID-19 on social disconnection and isolation, a total of three items were utilized. All items assessed feelings of loneliness, with two of the items asking participants to rate their sense of social disconnection and isolation since the COVID-19 outbreak on a scale of 0 ("Not at all") to 4 ("Very much") and the other asking for the rating of changes in their experience of loneliness by asking whether they have "become more lonely" since the COVID-19 pandemic on a scale of 1 ("Strongly disagree") to 5 ("Strongly agree"). The third item had participants rate their emotional experience of loneliness from 0 to 100 in relation to social distancing. Internal consistency was poor (α = 0.09); therefore, the items were assessed separately as independent measures of social disconnection and isolation, changes in experience of loneliness, and loneliness due to social distancing.

Financial Impact Three questions were used to quantify the financial impact of COVID-19 regulations. One item assessed the financial impact of COVID-19 on a scale of 0 ("Not at all") to 4 ("Very large"). The two items were on a scale of 1 ("Not at all true for me") to 3 ("Very true for me") and assessed the financial distress caused by COVID-19 ("I have increased financial stress because of COVID") and the impact COVID-19 has had on their life ("I lost my job or had to reduce hours at work due to COVID"). Internal consistency showed that the three items were correlated (α = 0.75) and were combined into a sum score after a z-score transformation to account for the different assessment scales.

Pandemic-Related Concerns Fifteen items assessed different concerns related to the general impact of the pandemic such as, "I worry a lot about COVID," "I worry I do not have control over what the future holds," and "I worry that I am not going to get the medical attention I need." Please see supplemental materials for a full list of items and scale information. The internal consistency of these items was excellent (α = 0.90) and was sum-scored after a z-score transformation.

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[2] The description of all COVID-19 questions included for analysis is provided in Table S2 in supplementary materials.

COVID-19 Contagion Anxiety Seven items assessed sentiments regarding getting sick from COVID-19 such as, "If I cough, sneeze, or have a sore throat, I am worried that I have COVID-19," "I am worried I will infect others," and "I am afraid for my physical health." Please see supplemental materials for a full list of items and scale information. The internal consistency of these items was good ($\alpha = 0.82$) and were sum-scored after a z-score transformation.

Preventative Behaviors Twenty questions measured engagement in preventative behaviors in response to COVID-19 risk such as mask-wearing, disinfecting the home and other items, and limiting activities. The internal consistency of these items was excellent within this sample ($\alpha = 0.91$); thus, the items were sum-scored after a z-score transformation.

Quarantine-Related Items Two items assessed participants' quarantine situation ("I have quarantined by myself (with family members or roommates) because of COVID" and "I have quarantined by myself (with nobody else) due to COVID") on a scale of 1 ("Not at all true for me") to 3 ("Very true for me"). Two items were poorly correlated ($\alpha = 0.34$); therefore, they were assessed separately.

Coping Behaviors Four items were utilized to assess participant engagement in coping behaviors. Participants were asked to rate how much time they spent talking to romantic partners, time spent talking to close friends and family, how much they engaged in virtual hangouts, and time spent on social media since the COVID-19 pandemic. The internal consistency of these items showed that they were not correlated enough to sum score ($\alpha = 0.53$), so they were analyzed separately.

Firearm Ownership and Purchasing Behaviors Firearm ownership and willingness to purchase were measured using two questions. The first question assessed whether the participant owned a firearm; the second assessed whether willingness to purchase a firearm increased since the outbreak of COVID-19 on a scale of 1 ("Strongly disagree") to 5 ("Strongly agree"). Correlation analysis showed that the two items were not correlated at all ($\alpha = -0.053$); therefore, they were analyzed separately.

Data-Analytic Plan

All data analyses were conducted using the software R (Version 1.3.1093). First, correlation analyses were conducted to examine the relationship between suicidal ideation severity in the past month and demographics, such as age, gender, ethnicity, race, sexual orientation, and diagnosis of COVID-19 in order to test for potential covariates that would need to be accounted for. Then, multivariate regression models were estimated to test whether the behavioral, economic, or psychological consequences of COVID-19 accounted for a significant proportion of the variance of peri-pandemic suicidal ideation severity above and beyond the variance of pre-pandemic suicidal ideation severity and identified covariates.

Results

Correlation analyses examining associations between suicidal ideation severity in the past month and demographic variables and the diagnosis of COVID-19 identified significant associations between peri-pandemic suicidal ideation severity and sexual orientation. No other variables were found to be significantly correlated with peri-pandemic suicidal ideation severity. Thus, sexual orientation was included as a covariate in all subsequently estimated regression models.

Multiple regression models showed significant positive relationships between peri-pandemic suicidal ideation severity and the following variables even after accounting for pre-pandemic suicidal ideation and sexual orientation: 1) changes in experience of loneliness; 2) loneliness due to social distancing; 3) pandemic-related concerns; 4) COVID contagion anxiety; and 5) quarantining alone. Significant negative relationships were found for time spent talking to romantic partner and time spent talking to friends and family. To determine the incremental variance accounted for by behavioral, economic, or psychological consequences of COVID-19, the adjusted R^2 value of a baseline multiple regression model that predicted peri-pandemic suicidal ideation severity with pre-pandemic suicidal ideation and sexual orientation ($R^2 = 0.083$) was subtracted from each multiple regression model to calculate an R^2 difference value (ΔR^2). Among the seven variables that emerged as significant correlates of peri-pandemic suicidal ideation, ΔR^2 was highest for COVID contagion anxiety ($\Delta R^2 = 0.11$) and quarantining alone ($\Delta R^2 = 0.11$), and lowest for loneliness ($\Delta R^2 = 0.03$). Detailed results of the regression models can be found in Table 1.

Table 1 Multiple regression analysis results

Item	b	SE	p value	ΔR^2
Social connection	.04	.11	.709	-.01
Changes in experience of loneliness	.18	.09	.047	.03
Loneliness due to social distancing	.01	.00	.019	.05
Financial impact	.07	.05	.118	.01
Pandemic-related concerns	.02	.01	.049	.05
Preventative behaviors	.02	.01	.098	.02
COVID contagion anxiety	.07	.02	.002	.11
Time spent talking to romantic partner	-.20	.07	.003	.08
Time spent talking to friends/family	-.18	.07	.010	.06
Virtual hangouts	.21	.01	.066	.05
Time spent on social media	.16	.10	.105	.02
Depression	.04	.02	.144	.01
PSWQ	.04	.03	.159	.01
Gun ownership	.18	.77	.812	-.01
Increased thoughts of purchasing a gun	-.11	.17	.532	-.01
Quarantine with others	.08	.15	.610	-.01
Quarantine alone	.86	.24	< .001	.11

Discussion

The primary aim of this study was to examine the relationship between the behavioral, economic, or psychological consequences of COVID-19 and suicidal ideation severity in a sample of young adults. We analyzed data collected data from a sample of undergraduate students assessed both pre-pandemic (January 2020) and peri-pandemic (April, June, and July 2020). Of note, the current study has several strengths, with the most prominent being the longitudinal study design that enabled pre-pandemic levels of suicidal ideation to be accounted for in our analyses.

Overall, our hypotheses were partially supported: in the sample of participants who completed peri-pandemic measures during April to June 2020, changes in experience of loneliness, loneliness due to social distancing, pandemic-related concerns, COVID contagion anxiety, and quarantining alone emerged as significant positive correlates and time spent talking to romantic partner and time spent talking to friends and family were found to be significant negative correlates, while all other variables were nonsignificant.

Several meaningful interpretations can be drawn from our findings. First, pandemic-related concerns and COVID contagion anxiety emerged as significant predictors of peri-pandemic suicidal ideation, while generalized anxiety symptoms as measured by PSWQ scores did not. An interpretation that can be drawn from this is that anxiety and worry specific to COVID-19 and the pandemic better account for the variance of peri-pandemic suicidal ideation compared to generalized anxiety. Such prominence of worry and anxiety specific to the pandemic and COVID-19 is consistent with previous findings: Elbogen et al., (2021), Lee et al., (2021), and Killgore et al., (2020a, 2020b) all found a significant association between psychological worry about COVID-19 and suicidal ideation in US adults. It should also be noted that COVID contagion anxiety had the highest ΔR^2 value ($\Delta R^2 = 0.11$) among all significant correlates of peri-pandemic suicidal ideation in our sample, even surpassing that of pre-pandemic suicidal ideation ($\Delta R^2 = 0.09$), further implicating COVID-specific anxiety as a salient predictor of peri-pandemic suicidal ideation. Altogether, such findings from our sample further the findings of previous literature that examined the association between COVID-19 and pandemic-specific anxiety and peri-pandemic suicidal ideation by demonstrating the importance of the context of the anxiety and highlighting its significance above and beyond pre-pandemic suicidal ideation.

Considering the importance of the context of psychopathologic symptoms, the nonsignificance of MDD symptoms in our sample could be interpreted as a result of the lack of context specificity in its measure. We adopted measures that assessed for the eight MDD symptoms without restricting its context to the pandemic, and the resulting MDD variable shared a significant correlation with peri-pandemic suicidal ideation severity when pre-pandemic suicidal ideation severity was not accounted for. One possible explanation that can be drawn is that the association between MDD symptom severity and peri-pandemic suicidal ideation was due to the relationship between MDD symptoms and pre-pandemic suicidal ideation. An alternative explanation may be that peri-pandemic suicidal ideation that is not accounted

for by pre-pandemic suicidal ideation is better explained by psychological consequences that are direct byproducts of the pandemic and its prevention efforts. The nonsignificance of both MDD severity and generalized anxiety symptom severity measures in the final regression models lend some support toward the latter explanation and the importance of measurement context.

Second, subjective experience of loneliness, quarantining alone, and time spent communicating with partner, friends, and family were all significant correlates while sense of social disconnection and isolation, engagement in virtual hangouts, and time spent on social media were not. Such findings are consistent with previous literature: Elbogen et al., (2021), Killgore et al., (2020a, 2020b), and Antonelli-Salgado et al., (2021) also found loneliness to be a significant correlate of peri-pandemic suicidal ideation, and Elbogen et al., (2021) also documented social support as a significant correlate as well. Interestingly, both feelings of loneliness and quarantining alone were significant correlates of peri-pandemic suicidal ideation severity, with quarantining alone having the second highest ΔR^2 value ($\Delta R^2 = 0.11$) among all significant correlates of peri-pandemic suicidal ideation. Such findings demonstrate both subjective and objective experiences of loneliness may be significant contributors to suicidal ideation severity, even after accounting for any suicidal ideation that may have been present prior to the pandemic. Additionally, the time spent on modalities that facilitate connection (e.g., virtual hangout platforms and social media) lacked significant associations with peri-pandemic suicidal ideation, while time spent talking to partner, family, and friends was significantly and negatively correlated with peri-pandemic suicidal ideation. One possible interpretation of this finding is that quality of social contact may matter more than time, as virtual hangout and social media platform engagement may not be limited to people's direct social circles, while most people would describe their partner, family, and friends as loved ones they engage with for social support. The significance of time spent talking with partner, friends, and family becomes even more noteworthy considering that quarantining with others was nonsignificant, further suggesting that contact with loved ones matter much more than mere presence of other people. Overall, our findings support voices of concern that pandemic prevention efforts may indirectly result in social disconnections and isolation that may contribute to suicidal ideation (e.g., Reger et al., 2020), and also indicate these can be mitigated by encouraging social contact with loved ones.

Third, engagement in preventative behaviors lacked significant associations with suicidal ideation within our sample of young adults, which suggests some psychological problems may not be mitigated through preventative behaviors. In the context of the pandemic, engagement in preventative behaviors may instill a sense of security and protection, as suggested by a study conducted on a sample of Polish adults. Szczesniak et al., (2020) found that psychological problems of anxiety, depression symptoms, and social dysfunction were significantly lower in an adult sample whose data were collected after the Polish government's implementation of face mask requirements, when compared with a sample who was surveyed prior to the government-mandated mask requirement. Our findings may suggest that psychological problems such as suicidal ideation may not benefit from the buffering effect produced by preventative behaviors that reduce some COVID-19-related distress in

young US adults. Engagement in preventative behaviors may have been limited in this sample due to participant age, as our sample may have felt less susceptible to the COVID-19 threat toward physical health. Further, unlike Poland, the USA never adopted a national mask mandate, which may have been the factor responsible for decreases in psychological problems in Szczesniak et al., (2020)'s sample.

Fourth, our findings imply the relationship between financial impact of COVID-19 and suicidal ideation may be nonsignificant in the short-term when immediate financial impacts are mitigated. It should be noted such finding in our data directly contrasts that of other studies (e.g., Elbogen et al., 2021), which found various financial stressors to be significantly correlated with peri-pandemic suicidal ideation. Our finding also contrasts other previous studies that suggest young adults are especially vulnerable to economic recessions (Glover et al., 2020; Kahn, 2010; Rothstein, 2019; Schwandt & Von Wachter, 2019), which could result in higher rates of suicide mortality (Case & Deaton, 2020). One possible reason for the nonsignificance of financial impact may include the monetary support the young adults in this sample received through the CARES Act that took place on March 25, and the partial refunds from the university for housing/dining that were provided on April 6, which was only a few days prior to when majority of the participants completed their peri-pandemic measures. Moreover, short-term financial impact may not be sufficient to explain the influence of financial difficulty on suicidal ideation. If suicidal ideation is influenced only by chronic, but not acute financial distress, a one-to-three-month period may be sufficient to capture the full financial impact on suicidal ideation severity.

Finally, firearm ownership and willingness to purchase were not significantly correlated with suicidal ideation severity within this sample. One potential explanation is that gun purchase during the pandemic may serve as a coping strategy for high levels of uncertainty in safety and fear of becoming a victim of crime, as opposed to an indicator of increased risk for suicide. Although gun sales reached an all-time high in March, such significant increases are not unprecedented during times of great political uncertainty and following events that instill a sense of threat to physical safety. Rather, gun sales are likely to reflect the willingness to protect oneself as opposed to an increased desire to harm oneself. In this context, the surge of gun sales during the pandemic may be of a similar nature and lack a direct relationship with suicide risk (but see Studdert et al., 2020). Alternatively, firearms may have been of less interest within this sample due to lack of familiarity or general interest in firearm ownership, as evidenced by the very low proportion of gun ownership and increased willingness to purchase a gun. This may have been attributable to the higher proportion of participants who self-identified as female in our sample, as females are less likely than males to purchase firearms, or low variance across items assessing firearm ownership and willingness to purchase a gun.

Limitations and Future Directions

Although our sample was relatively small ($n = 90$), we collected data on many behavioral, economic, and psychological correlates of COVID-19 and the pandemic prevention efforts. We also tested the unique contribution of these correlates of

COVID-19 on peri-pandemic suicidal ideation while accounting for pre-pandemic suicidal ideation. However, our study comes with several limitations. Our sample consists only of university students at a southeastern state university, and characteristics of our sample may restrict the extent to which our findings can be generalized. Therefore, additional studies are needed with nationally representative participants. Moreover, our outcome variable was limited to suicidal ideation severity and did not account for suicidal behaviors, suicide attempts, passive levels of suicidal ideation such as wishes to go to sleep and not wake up, or any other alternative aspects of suicide risk that could occur within the context of COVID-19. Given that the risk factors for suicidal ideation are likely to be different from those that predict suicidal behaviors and suicide attempts (Klonsky et al., 2016), future studies should aim to examine the impact of COVID-19 and its prevention efforts on different levels of severity of suicidal thoughts and behaviors.

It is also worth noting that our peri-pandemic period data collection took place between March to July of 2020. While our study findings are meaningful in examining the impact of the COVID-19 pandemic and preventative efforts, it is important to consider that many political and societal changes have occurred since, and young adults may have become psychologically even more vulnerable. Given that COVID-19 continues to impact people worldwide, future studies should aim to model the pandemic's longitudinal repercussions to better anticipate its consequences on mental health, as its effects may impact people for an extended period.

Additionally, some relationships between suicidal ideation severity and COVID-19 variables may have emerged as nonsignificant due to insufficient power. Our sample size ($n = 90$) and the skew of the dependent variable due to only a small portion of our sample endorsing nonzero peri-pandemic suicidal ideation limited statistical power. Given that analyses of skewed variables require a much larger sample size than analysis of normally distributed variables to have sufficient power (Rhemtulla et al., 2012), certain relationships that would have emerged as significant may not have within our sample. Nonetheless, it should be noted limitations due to a small proportion of people endorsing suicidal ideation is inevitable in community samples, and the percentage from our data is comparable to other studies that recruited from the local community (Piscopo et al., 2016). Future studies should attempt to reexamine these relationships in a larger sample with sufficient power.

Finally, we primarily used individual items as opposed to validated scales to measure the impact of COVID-19. Although we combined several items that were strongly intercorrelated into scales to increase reliability, majority of our measures were individual items. Ideally, we would have used a previously validated scale with demonstrated internal consistency and reliability; however, such measures were in development and not yet widely available at the time materials were assembled for the re-administration of the survey.

Declarations

Conflict of Interest The authors have no conflict of interest to disclose.

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