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The moderating effects of reported pre-pandemic social anxiety, symptom impairment, and current stressors on mental health and affiliative adjustment during the first wave of the COVID-19 pandemic

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Background and objectives: Individuals with social anxiety (SA) have well-established fears of being negatively evaluated and exposing self-perceived flaws to others. However, the unique impacts of pre-existing SA on well-being and interpersonal outcomes within the stressful context of the pandemic are currently unknown. **Design:** In a study that took place in May 2020, we surveyed 488 North American community participants online. **Methods:** We used multiple linear regression to analyze whether retrospective reports of pre-pandemic SA symptoms predicted current coronavirus anxiety, loneliness, fears of negative evaluation, use of preventive measures, and affiliative outcomes, and whether pre-pandemic functional impairment and recent COVID-related stressors moderated these relations. **Results:** Results highlighted the negative effects of pre-pandemic SA on current mental health functioning, especially for participants with higher pre-pandemic functional impairment and greater exposure to COVID-related stressors. Although participants with higher pre-pandemic SA reported currently feeling lonelier and more fearful of negative evaluation, they also endorsed greater efforts to affiliate with others. **Conclusions:** High SA individuals may have heightened desire for social support within the isolating context of the pandemic, in which COVID-related social restrictions enable greater avoidance of social evaluation but may also mask the enduring impairment associated with pre-pandemic SA.

Keywords: social anxiety, pandemic, COVID-19, impairment, stressors, social support

Introduction

Deep and meaningful social connections are instrumental to well-being (e.g., Baumeister & Leary, 1995); however, individuals with high social anxiety (SA) have difficulty affiliating with others to facilitate these connections due to their intense fears of negative evaluation (FNE) and avoidance of social threat, mechanisms well-studied within a pre-pandemic context (Clark & Wells, 1995; Rapee & Heimberg, 1997; Wong, Gordon, & Heimberg, 2014). As a result, SA individuals tend to either withdraw from social situations entirely, or rely on maladaptive self-protective strategies to conceal self-perceived flaws (Moscovitch, 2009; Moscovitch et al., 2013). Unfortunately, such strategies diminish SA individuals' social functioning, often leading to chronic loneliness and impaired positive connections (Alden,

Regamball, & Plasencia, 2014; Gilboa-Schechtman et al., 2014; Kashdan et al., 2011; Rowa et al., 2015; Placensia et al., 2016).

While multiple studies have reported rising levels of anxiety and depression in the general population as a result of the COVID-19 pandemic (e.g., Gallagher et al., 2020; Loades et al., 2020), it remains unknown how individuals who experienced elevated SA prior to the pandemic have been impacted, especially given the isolating nature of the preventive efforts to curb the spread of COVID-19. For SA individuals, pandemic-related restrictions, in addition to already existing social fears, may block adequate social connection and support during the pandemic. Alternatively, SA individuals who struggled significantly before the COVID-19 pandemic may feel relieved by pandemic-related social restrictions, which might lower FNE and improve their willingness to seek out the support and companionship they desire without having to confront their typically feared situations.

The degree to which socially anxious individuals' affiliative efforts and associated coping abilities are hindered during the pandemic may also depend on how disabling their SA symptoms are—that is, the extent to which symptoms cause interference with and impairment in various life domains, such as work/ school, social relationships, or home life. Indeed, social anxiety disorder (SAD) exerts negative consequences across multiple life domains, predicting higher rates of school dropout and unemployment as well as lower socioeconomic status and overall quality of life (Stein & Kean, 2000). However, since symptom severity is not necessarily strongly correlated with functional impairment (McKnight et al., 2016), it is important to consider how SA-related impairment, in addition to SA severity, might influence the impact of symptoms on various outcomes.

Furthermore, everyone's adjustment during the COVID-19 pandemic is impacted by the unique encounters they have had with specific COVID-related stressors, such as becoming ill, caring for dependents, or losing employment, which have been associated with increased

stress, anxiety, depression, and functional impairment (Dozois, 2020; Gallagher et al., 2020). COVID-related stressors may differentially impact socially anxious individuals, as certain cognitive biases may make it difficult for them to feel well-equipped to handle stress: compared to healthy controls, individuals with SAD were found to perceive anxiety and pain as more interfering with progress towards their goals regardless of how much effort and progress they actually made (Goodman & Kashdan, 2019). Furthermore, after controlling for symptom severity, individuals with SAD were more likely to hold entity beliefs—beliefs that emotions are fixed and not amenable to change—in relation to their own emotions and anxiety (De Castella et al., 2014), suggesting that SA individuals may be less effective at coping in the face of increased anxiety and stressors, such as those caused by the pandemic.

We conducted a correlational study to determine the unique impact of retrospectively reported levels of pre-pandemic SA on key indicators of mental health and interpersonal adjustment during the first wave of the pandemic, in May 2020. Furthermore, we sought to understand whether and how the relations between longstanding symptoms of SA and current functioning may be moderated by levels of reported levels of pre-pandemic functional impairment and current COVID-related stressors. Our outcomes of interest included coronavirus-related anxiety, use of preventive measures, loneliness, FNE, and frequency of affiliative behaviors, as well as the degree of pleasure derived from any affiliative efforts.

We surveyed a large sample of community participants from the United States and Canada in late May of 2020, at which point the United States had approximately 20,000 new cases per day and had just exceeded 100,000 total COVID-related deaths, while Canada was reporting approximately 900 new cases per day and had exceeded 6,000 total deaths (World Health Organization, 2020). At the time of data collection, states and provinces in both countries were beginning the process of lifting stay-at-home orders that had been in place

since March and April. We hypothesized that higher levels of pre-pandemic SA would be associated with:

1. Greater current levels of coronavirus-related anxiety and loneliness,
2. Greater greater use of COVID-related preventive measures as well as decreases in current FNE during the unique pandemic context,
3. Decreased social support-seeking and less engagement in affiliative behaviors, as well as reduced feelings of social pleasure and connection within the pandemic context, and
4. The effects in hypotheses 1-3 would be amplified by both greater pre-pandemic levels of SA-related impairment and greater reported COVID-related stressors.

Methods

Participants

Full details on recruitment procedures can be found in Supplementary Materials. The final sample consisted of 488 participants recruited from both the US and Canada via Amazon Mechanical Turk (MTurk). Details regarding the demographic characteristics of the sample can be found in Table 1 and a map of the geographic distribution of participants is available in Supplemental Materials (Figure S1). We aimed to recruit 800 participants to target a sample size of 735 based on conservative *a priori* power analyses indicating this sample size would provide power greater than 0.80 to detect small to medium associations (r's > 0.20) at alpha of .05. Post-hoc power analyses demonstrated that for our planned regression analyses involving a maximum of seven predictor variables, our final sample provided power ranging from 0.85 to 1.00 at alpha of .05, given effect sizes (Cohen's f^2 values) ranging between 0.03 and 1.19 across analyses.

The plan for our study procedures can be accessed at https://osf.io/rjhgx/?view_only=026eb6dfe59d4703b3047402448c7082. As noted, we also collected additional questionnaire data related to other types of anxiety symptoms (including

obsessive-compulsive, generalized anxiety, and health anxiety) that were not relevant for the present study. After completing the 90-minute survey, participants were debriefed and remunerated US $3.50 for their participation. All participants provided informed consent online by clicking an option indicating their agreement to participate in the research study. This study was approved by the University of Waterloo's Office of Research Ethics (#42089).

Measures

Retrospective reports of pre-pandemic SA symptoms

The Social Interaction Anxiety Scale (SIAS; Mattick & Clarke, 1998) was used to retrospectively assess pre-pandemic SA. Participants were asked to rate the items as applicable to them "in the year prior to the COVID-19 outbreak." The SIAS has good test-retest reliability, convergent validity, and internal consistency, and can distinguish between individuals with and without SAD (Mattick & Clarke, 1998). Only straightforward items were included in creating a final sum score for the SIAS.[1] Internal consistency of our sample was strong at $\alpha = .97$.

Retrospective reports of pre-pandemic functional impairment from SA

The Sheehan Disability Scale (SDS; Sheehan, 1996) is a three-item instrument that assesses functional impairment in three domains: work/ school, social, and family life. The total sum score on the SDS has previously been shown to have an internal consistency $\alpha = .89$ in a sample of 1001 individuals in a primary care setting with over 80% of individuals with a diagnosed mental disorder having an elevated score (Leon et al., 1997). Participants retrospectively rated the extent to which each domain was impaired by their concerns about social evaluation "in the year prior to the COVID-19 outbreak" on a visual analog-scale from

[1] Because the four reverse-scored items of the scale have been shown to compromise validity, while the remaining straightforward items have demonstrated excellent internal consistency across a variety of samples (for example, $\alpha = .95$ in an MTurk sample; Rodebaugh, Woods, & Heimberg, 2007; Rodebaugh et al., 2011), only straightforward items were included. We replicated the results of our models using the SIAS with reverse-coded items retained. Thus, results are reported with the reverse-scored items removed, consistent with Rodebaugh et al.'s (2011) recommendations.

1 (*not at all*) to 10 (*extremely*). For participants who indicated that they had not worked or studied at all over the past year for reasons unrelated to social evaluation concerns, their rating for the work/school domain was imputed by calculating the mean of their ratings for the social life and family life domains. Internal consistency of the SDS in our sample was α = .89.

COVID-related stressors

The "stressful experiences" section of the Coronavirus Stressor Survey (CSS; McLean & Cloitre, 2020) probes whether participants themselves or people close to them have experienced any of the following strictly due to COVID-19: becoming ill; being hospitalized; having a job that job requires possible exposure; losing income; increased home responsibilities; and difficulties accessing food, medication or other necessities. Participants indicated whether each experience has happened to them (assigned a score of 2), someone close to them (score of 1), or not at all (score of 0), and from these a sum score was created. Internal consistency of the CSS in our sample when scored in this way was α = .73.

Current coronavirus anxiety

The Coronavirus Anxiety Scale (CAS; Lee, 2020) instructs participants to endorse how often they have experienced any of the following five COVID-related worries or bodily symptoms of anxiety over the last 2 weeks on a Likert scale ranging from 0 (*not at* all) to 4 (*nearly every day over the last 2 weeks*). Items are summed to create a total score. The scale was developed as a brief mental health screener to classify between adults as having (90% sensitivity) or not having (85% specificity) dysfunctional levels of anxiety (Lee, 2020). Internal consistency of the sum-scored items in our sample was excellent, α = .93.

Current loneliness

The Three-Item Loneliness Scale asks participants how often they feel that they lack companionship, feel left out, and feel isolated from others on a scale from 1 *(hardly ever*) to 3

(often), and has previously demonstrated an internal consistency of α = .72 (Hughes et al. 1999). Internal consistency was α = .83 in our sample.

Current use of preventive measures

Participants were asked to rate the frequency at which they used specific COVID-19 preventive measures (listed in Table S1) over the past week on a scale of 0 (*never*) to 4 (*all the time*). The final item, "stocking up on food and other items," was excluded from analysis due to having 61.43% of missing values. The scale demonstrated strong internal consistency, α = .90.

Change in fear of negative evaluation

The Brief Fear of Negative Evaluation Scale (BFNE; Leary, 1983) is a 12-item, condensed version of the Fear of Negative Evaluation Scale (Watson & Friend, 1969) that is highly correlated with the full-length version (r = .96) and has demonstrated an internal consistency of α = .90 (Leary, 1983). To assess how participants' fear of negative evaluation may have changed since the start of the pandemic, we adapted the scale by asking participants to indicate their agreement with each statement "over the last week, as a result of social distancing" on a scale of 1 (*significantly less than before*) to 7 (*significantly more than before*), which was then rescaled to range from -3 to 3 for data analysis, with 0 representing no change. The adapted measure demonstrated good internal consistency in our sample (α = .81).

Current affiliative behaviors compliant with COVID-related restrictions

Participants rated various author-constructed items reflecting different ways they may have tried to connect with others over the prior week during the COVID-19 pandemic that were considered safe, distanced, and compliant with COVID-related restrictions. As listed in Table S1, items included various forms of digital communication, as well as distanced in-person activities such as visiting others while maintaining sufficient physical distance. Participants

rated their past-week frequency of use, their level of experienced social connection when used, and the extent to which they experienced a positive emotional response to each COVID-compliant affiliative behavior on a scale of 0 (less) to 4 (more). Frequency of affiliative behaviors and social connection from affiliative behaviors were highly correlated, $p = .87$, and thus were averaged into to create a composite score, which we labeled "affiliative frequency and connection." This measure demonstrated excellent internal consistency, $\alpha = .93$. Emotional response to affiliation also demonstrated good internal consistency, $\alpha = .79$.

Data preparation and data analytic plan

Data were screened to determine whether they met the assumptions of normality; methods included visually examining the distribution of scores in histograms and the normal Q-Q plot, inspecting the standard error of skewness and kurtosis, and inspecting the data for discontinuous and extreme outliers.

All variables were screened for extreme skewness (>3) and kurtosis (>10) as recommended by Kline (2008). Histograms and normal Q-Q plots were visually examined. No key variables showed significant univariate violations of normality. Univariate outliers were defined as any datapoint exceeding 3 standard deviations from the mean (Kline, 2008), and multivariate outliers were identified by Mahalanobis distance. A maximum of nine univariate outliers for an individual construct and a total of five multivariate outliers were identified; however, due to the novel context of the first wave of the pandemic and the fact that the scores fell within the allowable range for the scales, these were retained in subsequent analyses. We then examined the extent and pattern of missing data. Little's MCAR tests showed that all missing data were missing completely at random (MCAR). The frequency of missing data never exceeded 5% for any variable; thus, missing scale scores were replaced using expectation-maximization. The assumption of homoscedasticity was examined and

deemed met in all cases based on bivariate scatterplots reflecting associations between independent and dependent variables.

Data were analyzed in IBM SPSS Statistics 26 (2019) using multiple linear regression to determine whether pre-pandemic SA symptoms predicted current outcomes of interest, and whether pre-pandemic functional impairment and recent COVID-related stressors moderated these relations. Predictor variables were centred based on their respective grand means and entered hierarchically, with pre-pandemic SA, pre-pandemic functional impairment, and COVID-related stressors entered on the first three steps, respectively, all two-way interaction terms entered on the fourth step, and the three-way interaction term entered on the fifth step. The conditional effects of pre-pandemic SA on current outcomes at varying levels of pre-pandemic impairment and COVID-related stressors were probed using the PROCESS macro (Hayes, 2013). All collinearity statistics were within acceptable range (VIF < 4, tolerance > .20; Hair et al., 1995).

Results

Descriptive statistics and sample characteristics

Means and standard deviations for measures used in the present study appear in Table 2. Correlations between all independent and dependent variables can be found in Table S2.

Coronavirus anxiety

We hypothesized that pre-pandemic SA symptoms would predict greater coronavirus anxiety and that moderators would heighten the strength of the association. See Table S3 for multiple linear regression results. In the first step of the model, there was a positive main effect of SA, $B = 0.15$, $SE = 0.01$, $\beta = .60$, $t(486) = 16.42$, $p < .001$, that accounted for 36% of the variance in coronavirus anxiety, $R^2 = .36$, $F(1, 486) = 269.68$, $p < .001$. There was also a positive main effect of pre-pandemic impairment when added in the second step, $B = 0.24$, $SE = 0.03$, $\beta = .39$, $t(485) = 8.78$, $p < .001$, which explained significant additional variance in

coronavirus anxiety, ΔR^2 = .09, F (1, 485) = 77.14, p < .001. In the third step, the positive main effect of COVID-related stressors (B = 0.55, SE = 0.06, β = .32, t(484) = 9.63 , p < .001) explained an additional 9% of variance in coronavirus anxiety, ΔR^2 = .09, F (1, 484) = 92.70, p < .001, while main effects remained significant for both pre-pandemic SA (B = 0.07, SE = 0.01, β = .28, t(484) = 6.88 , p < .001) and impairment (B = 0.21, SE = 0.03, β = .33, t(484) = 8.10 , p < .001).

The moderating effects of pre-pandemic impairment and COVID-related stressors contributed an additional 3% of variance when entered on the fourth step, ΔR^2 = .03, F (3, 481) = 10.54, p < .001. The two-way interaction of SA x impairment was significant, B = 0.00, SE = 0.00, β = .13, t(481) = 3.70, p = .001, as was the two-way interaction between SA x stressors, B = 0.01, SE = 0.00, β = .16, t(481) = 3.81, p < .001, and the two-way interaction between impairment x stressors, B = -0.02, SE = 0.01, β = -.08, t(481) = 2.03 , p = .043. The significant two-way interactions indicate that impairment and stressors each strengthened the positive effect of SA on coronavirus anxiety. These two-way interactions were qualified by a significant three-way interaction between SA, impairment, and stressors in the final step of the model (B = 0.00, SE = .000, β = -.08, t(480) = 2.29, p = .023) that explained an additional 1% of variance in coronavirus anxiety, ΔR^2 = .01, F (1, 481) = 9.09, p = .003. Specifically, SA had a significant positive conditional effect on coronavirus anxiety when either impairment or stressors were high. As shown in Figure 1, the magnitude of the positive conditional effect was greatest when impairment and stressors were both high, B = 0.13, SE = 0.02, t(480) = 6.43, p < .001, followed by the conditional effect at low impairment and high stressors, B = 0.10, SE = 0.02, t(480) = 5.62, p < .001, and at high impairment and low stressors, B = 0.09, SE = 0.02, t(480) = 4.58, p < .001. There was no association between pre-pandemic SA symptoms and current levels of coronavirus anxiety when both impairment and stressors were low, B = -0.01, SE = 0.02, t(480) = 0.68, p = .499.

Loneliness

We hypothesized that SA would predict increased levels of current loneliness, and that this relationship would be further strengthened by impairment and stressors. As expected, SA significantly predicted increased loneliness when entered in the first step of the model, B = 0.05, SE = 0.00, β = .51, $t(486) = 13.09$, $p < .001$, and accounted for 26% of variance, R^2 = .26, $F(1, 486) = 171.28$, $p < .001$ (see Table S4). Impairment entered on the second step also had a positive main effect on loneliness, B = 0.04, SE = 0.01, β = .18, $t(485) = 3.49$, p = .001, and explained an additional 2% of unique variance, ΔR^2 = .02, F (1, 485) = 12.190, p = .001, as did stressors when entered on the third step, with an additional 1% of variance, ΔR^2 = .01, F (1, 484) = 5.71, p = .02. Each predictor variable on its own was significantly associated with loneliness when controlling for the others on the third step: SA had a positive main effect on loneliness, B = 0.04, SE = 0.01, β = .38, $t(484) = 7.45$, $p < .001$, as did impairment, B = 0.04, SE = 0.01, β = .16, $t(484) = 3.13$, p = .002, and COVID-related stressors, B = 0.07, SE = 0.03, β = .10, $t(484) = 2.39$, p = .017. There were no significant interaction effects, nor did they explain additional variance in subsequent steps, indicating that the relationship between SA and loneliness was not moderated by either impairment or stressors.

Frequency of use of preventive measures

We hypothesized that SA would predict greater use of preventive measures and that these effects would be moderated by impairment and COVID-related stressors. Entering pre-pandemic SA in the first step of the model explained only 1% of variance in preventive measures, R^2 = .01, $F(1, 486) = 5.81$, p = .02 (see Table S5), and contrary to our hypothesis, greater SA predicted less frequent use of preventive measures, B = -0.02, SE = 0.01, β = -.11, $t(486) = 2.41$, p = .016. When pre-pandemic impairment was entered on the second step, there was no significant additional variance explained, nor when COVID-related stressors was

entered on the third step, but the main effect of SA remained significant after impairment and stressors were included, B = -0.02, SE = 0.01, β = -.12, t(484) = 2.00, p = .047. The two-way moderating effects of impairment and stressors entered on the fourth step contributed significantly to the model, ΔR^2 = .04, F (1, 481) = 5.89, p = .001. The two-way interaction between SA x impairment was significant, B = 0.00, SE = 0.00, β = .17, t(481) = 3.32, p = .001, as was the two-way interaction between SA x stressors, B = 0.00, SE = 0.00, β = .15, t(481) = 2.42, p = .016. When simple slopes were probed, there was a significant negative conditional effect of SA on use of preventive measures at low impairment (B = -0.05, SE = 0.01, β = -.26, t(481) = 3.58, p < .001), but no conditional association at high impairment (B = 0.01, SE = 0.02, β = .08, t(481) = 0.96, p = .337). There was also a significant negative conditional effect of pre-pandemic SA on use of preventive measures at low stressors (B = -0.04, SE = 0.02, β = -.24, t(481) = 2.81, p = .005), but not at high stressors (B = 0.01, SE = 0.02, β = .06, t(481) = 0.66, p = .509).

Change in fear of negative evaluation (FNE)

We hypothesized that pre-pandemic SA would predict a decrease in current FNE. Contrary to our hypothesis, in the regression model predicting change in FNE since the start of the pandemic (see Table S6), entering SA on the first step resulted in a significant positive main effect such that greater pre-pandemic SA predicted an increase in fear of negative evaluation during the pandemic, B = 0.21 SE = 0.02, β = .39, t(486) = 9.44, p < .001, accounting for 16% of variance, R^2 = .16, F(1, 486) = 89.17, p < .001. Including impairment as a predictor on the second step explained a marginally significant amount of additional variance in change in FNE, ΔR^2 = .01, F (1, 485) = 3.93, p = .048, with impairment also predicting increased FNE, B = 0.14, SE = 0.07, β = .11, t(485) = 1.98, p = .048, and the main effect of SA remaining significant, B = 0.17, SE = 0.03, β = .33, t(485) = 6.01, p < .001. When stressors were entered on the third step, there was no significant change to the model.

Further, contrary to hypotheses, impairment and COVID-related stressors did not moderate the relationship between pre-pandemic SA and changes in FNE.

Affiliation measures

Affiliative frequency and connection

We anticipated the composite score of affiliative frequency and social connection to decrease as pre-pandemic SA symptoms increased. Contrary to expectations, SA had a positive main effect on affiliative frequency and social connection in the first step, $B = 0.19$, $SE = 0.02$, $\beta = .39$, $t(486) = 9.21$, $p < .001$, and explained 14.7% of unique variance, $R^2 = .15$, $F\ (1, 486) = 84.72$, $p < .001$ (see Table S7). When entered on the second step, impairment significantly explained an additional 13.7% of variance, $\Delta R^2 = .14$, $F\ (1, 485) = 93.12$, $p < .001$, and had an unexpected positive main effect on affiliative frequency and connection, $B = 0.61$, $SE = 0.06$, $\beta = .48$, $t(485) = 9.65$, $p < .001$, and the main effect of SA was surprisingly no longer significant, $B = 0.04$, $SE = 0.03$, $\beta = .08$, $t(485) = 1.54$, $p = .124$. When entered on the third step, stressors contributed significantly to the model, $\Delta R^2 = .06$, $F\ (1, 484) = 41.24$, $p < .001$, and also had a surprising positive main effect on affiliative frequency and connection, $B = 0.87$, $SE = 0.14$, $\beta = .25$, $t(484) = 6.42$, $p < .001$. After stressors were included, impairment continued to have a positive main effect, $B = 0.55$, $SE = 0.06$, $\beta = .44$, $t(484) = 9.02$, $p < .001$, and the main effect of SA remained non-significant, $B = 0.01$, $SE = 0.02$, $\beta = .02$, $t(485) = 0.47$, $p = .638$.

The moderating effects of impairment and COVID-related stressors explained an additional 9.4% of unique variance, $\Delta R^2 = .09$, $F\ (3, 481) = 26.68$, $p < .001$. The two-way interaction between pre-pandemic SA x impairment was significant, $B = 0.02$, $SE = 0.00$, $\beta = .26$, $t(481) = 6.58$, $p < .001$, as was the two-way interaction between pre-pandemic SA x stressors, $B = 0.05$, $SE = 0.01$, $\beta = .27$, $t(481) = 5.72$, $p < .001$. Probing of simple slopes revealed that SA had a significant negative conditional effect on affiliative frequency and

connection at low levels of impairment, B = -0.10, SE = 0.03, β = -.19, t(481) = 3.41, p = .001, but a significant positive conditional effect at high levels of impairment, B = 0.16, SE = 0.03, β = .33, t(481) = 5.12, p < .001. SA had a negative conditional effect on affiliative frequency and connection at low stressors, B = -0.10, SE = 0.03, β = -.20, t(481) = 3.05, p = .002, but a positive conditional effect at high stressors, B = 0.17, SE = 0.03, β = .34, t(481) = 5.12, p < .001. When entered on the final fifth step, the three-way interaction between SA, impairment, and stressors failed to reach the required statistical threshold for explaining significant unique variance, ΔR^2 = .004, F (1, 480) = 3.44, p = .064.

Emotional response to affiliation

We hypothesized that pre-pandemic SA would predict a more negative emotional response to affiliation. Contrary to our hypothesis, the main effect of SA in the first step was non-significant (see Table S8). However, there was a small, positive effect of impairment on the second step, B = 0.13, SE = 0.05, β = .15, t(485) = 2.48, p = .014, which explained 1% unique variance in emotional response, ΔR^2 = .01, F (1, 485) = 6.13, p = .014. There was also a small but significant positive main effect of stressors when entered in the third step, B = 0.41, SE = 0.12, β = .17, t(484) = 3.51, p < .001, which also contributed significantly to the model, ΔR^2 = .02, F (1, 484) = 12.29, p < .001. When the moderating effects of impairment and COVID-related stressors were entered in the fourth step, an additional 11% of variance was explained, ΔR^2 = .11, F (3, 481) = 19.65, p < .001. Impairment significantly moderated the relationship between SA and emotional response in the SA x impairment interaction, B = 0.02, SE = 0.00, β = .35, t(481) = 7.06, p < .001, as did stressors in the two-way interaction between SA x stressors, B = 0.02, SE = 0.01, β = .16, t(481) = 2.69, p = .007. Probing of simple slopes revealed a surprising cross-over interaction: at low impairment, higher levels of SA were associated with less positive emotional responses to affiliation (B = -0.13, SE = 0.02, t(481) = β = -.37, t(481) = 5.35, p < .001); meanwhile, at high impairment, SA positively

predicted positive emotional responses to affiliation (B = 0.16, SE = 0.03, β = .33, t(481) = 5.12, p < .001). Including the three-way interaction in the fifth step did not contribute significantly to the final model.

Discussion

The present study examined the relations between retrospective reports of pre-pandemic SA symptoms and current mental health and interpersonal outcomes during the pandemic, as well as the potential moderating roles of pre-pandemic functional impairment and COVID-related stressors. Results partially supported hypotheses and emphasize several unique challenges that the COVID-19 pandemic has posed for socially anxious individuals. The study was conducted in May 2020, when information on COVID-19 was continually evolving and policies and preferences on how to respond effectively may have varied substantially across people and regions. Thus, though results of the present study reflect a particular point in time during the first wave of the pandemic, they may still provide valuable insights into how SA individuals have been responding and may also help lay the groundwork for future research as the pandemic continues to shift.

As hypothesized, higher levels of retrospective pre-pandemic SA predicted greater current levels of coronavirus anxiety, especially when pre-pandemic impairment and COVID-related stressors were high, with the final model explaining a large amount (56.2%) of the variance overall. These findings are consistent with recent research showing that individuals with a pre-pandemic anxiety-related diagnosis have been more negatively impacted by COVID-19-related stress than healthy controls (Asmundson et al., 2020), and are in line with classic cumulative risk hypotheses wherein a variety of risk factors, both environmental and individual, exhibit additive or interactive and synergistic consequences on key outcomes (Rutter, 1979; Sameroff, 2000). In support of our hypothesis regarding loneliness and interpersonal outcomes, increased retrospective pre-pandemic SA predicted increased feelings

of current loneliness, with pre-pandemic impairment and COVID stressors each independently explaining a significant, though small amount of incremental variance. These results are consistent with findings that SA, when compared to other mental health symptoms such as depression and paranoia, has unique longitudinal effects on loneliness (Lim et al., 2016). Those experiencing higher and more impairing SA may be more likely to avoid situations that would provide increased opportunities for social contact that could reduce loneliness. Greater exposure to COVID-related stressors may have also contributed to increased loneliness by forcing people to quarantine and self-isolate.

Contrary to our hypothesis on the use of preventive measures, pre-pandemic SA predicted lower use of preventive measures, such as social distancing or mask-wearing, especially at lower impairment; however, these effect sizes were small, with only 2.1% of variance explained by the final model. In fact, there was restricted variance overall, with most participants near ceiling in their reported frequency of preventive measures use, perhaps due to data collection occurring at a time when rate of COVID-19 transmission was high and many were exercising caution in the face of new public health guidelines. Additionally, at this early stage of the pandemic, there may have been large variability in people's attitudes towards preventive measures, as many of these measures had not yet been considered normative and in certain places, were politicized. The large amount of missing data for the "stocking up on household items" item of the scale may suggest the inconsistency of this behavior in the general population despite earlier narratives of stocking up being a common response to the pandemic, especially given evidence that stocking up or panic buying is a sporadic behavior catalyzed by threats of lockdown (Taylor, 2021). It is also possible this item was difficult for participants to quantify as "stocking up" and "household items" were not clearly defined.

Despite the lower use of preventive measures amongst SA individuals, pre-pandemic levels of SA predicted heightened FNE since the start of the pandemic, with a medium effect size and no reliable contributions from impairment or stressors. The association between pre-pandemic SA and current FNE may be attributable to the high degree of conceptual and psychometric overlap between the two constructs, though the collinearity statistics raised no concerns before proceeding with the regression model. Indeed, these increases in FNE are in line with maintenance models of SA (e.g., Clark & Wells, 1995; Rapee & Heimberg, 1997; Wong & Rapee, 2016) which suggest that avoidance and lack of learning opportunities to disprove feared outcomes (reinforced by social distancing and lockdown measures) would have the potential to exacerbate such symptoms. It is also possible that heightened FNE may be related to confronting novel, socially threatening situations, such as fearing others' criticism if their behavior fails to comply with pandemic-specific norms (e.g., wearing a mask in contexts where it is either required or unexpected). Whatever the reason, the fact that FNE have increased rather than decreased among those with higher levels of vulnerabilities suggest that the core symptoms of SA have not been abated by pandemic-related social restrictions.

In contrast to our hypothesis on the affiliative behaviors of socially anxious individuals during the pandemic, higher levels of SA, greater impairment, and more COVID-related stressors each independently predicted *greater* affiliative efforts during the pandemic. Moreover, pre-pandemic impairment and current COVID-related stressors each moderated the relationship between pre-pandemic SA and affiliative frequency and social connection during the first wave of the pandemic. Surprisingly, high SA individuals with the greatest functional impairment reported engaging the most frequently in affiliative behaviors, as well as those who had experienced the most stressors. These findings suggest that high levels of loneliness during the pandemic could be driving individuals with the most impairing pre-pandemic symptoms of SA to affiliate more with others, with the potential rewards of social connection

(in the face of isolation and loneliness from COVID-19) outweighing the risks of negative evaluation. This trade-off may be unique to the pandemic context, given previous research demonstrating socially anxious individuals' tendency to avoid and withdraw from social opportunities to connect with others (Heeren & McNally, 2018; Kirk et al., 2019). SA and loneliness have also been associated with a greater frequency of problematic social media use (O'Day & Heimberg, 2021), providing a potential explanation as to why SA individuals may be affiliating more often using methods compliant with COVID-related restrictions if many of their interactions are online. Furthermore, social interactions during the pandemic may inherently offer greater opportunities for self-concealment to counter SA individuals' intensified evaluative concerns, emboldening them to pursue more social opportunities. During the pandemic, SA individuals may be inconspicuously co-opting newly introduced social norms—such as communicating online, interacting from a physical distance, or conversing from behind a mask— as self-regulatory strategies, allowing them to remain concealed while conforming to societal expectations, and thus reducing the typical attentional costs of employing these strategies (Kashdan et al., 2011), especially for those with the highest levels of impairment. As for the moderating role of COVID-related stressors, such experiences may further encourage people to obtain social support to cope in difficult circumstances (Rimé, 2009; Schachter, 1959).

Our results also showed that affiliation-derived enjoyment depended on impairment, with individuals who reported higher pre-pandemic SA and greater impairment indicating *more* positive emotional responses to affiliation, whereas those who had not been as impaired by SA reported significantly less positive reactions towards affiliation during the pandemic. Additionally, pre-pandemic SA did not significantly predict emotional responses to affiliation among those who had experienced a greater number of COVID-related stressors, and in fact predicted more negative emotional responses to affiliation among those who had experienced

fewer COVID-related stressors. It is unclear whether highly impaired, SA participants truly experienced genuine social pleasure, or only perceived pandemic-specific affiliative behaviors as positive due to conferring greater levels of social safety relative to the pre-pandemic in-person interactions that would be appraised as more threatening (Moscovitch, 2009) and therefore less pleasurable (Gilboa-Schechtman et al., 2014; Kashdan, 2004). Furthermore, it is unclear why those burdened by fewer COVID-related stressors reported experiencing affiliation during the pandemic as more distressing and less enjoyable.

Although empirical testing of these possibilities remains an important target for future research, there is clear support in the existing literature for the idea that greater physical distance may reduce perceptions of social threat for socially anxious individuals (Azriel et al., 2020; Givon-Benjio et al., 2020; Kamalou et al., 2019; Rinck et al., 2010). Even though FNE have persisted during the pandemic, it is possible that SA individuals feel that physical distancing help keep others at a safer social distance, thereby promoting greater affiliative attempts. Additionally, high SA individuals may be selectively interacting with people to whom they feel closest and most comfortable—also known as "safety people"—further lowering the bar for affiliation by providing familiarity (Hofmann, 2014). Highly impaired individuals may also be the most likely to resort to close others for reliance and support, potentially explaining the positive association between impairment and pleasurable emotional responses to affiliation observed in our sample.

Several limitations of our research should be noted. Pre-pandemic SA symptoms and functional impairment were assessed retrospectively, resulting in potential cognitive biases such that the responses of those with high levels of internalizing symptoms during the pandemic could be influenced by selective memory for negative events and emotions. Conversely, it is possible that some may have underestimated their symptoms from the past year, especially if they viewed circumstances with COVID-19 as stressful in comparison.

Given the cross-sectional, correlational nature of the study, we were unable to take into account the rapidly evolving COVID-19 context over a longer period of time or incorporate a longitudinal design that would allow for repeated measurement of key constructs over time and enable us to draw conclusions about directional effects and causality. Furthermore, since we analyzed each outcome separately with hierarchical regression analyses, future studies may benefit from analyses using a structural equation modeling (SEM) framework to better account for any correlations between various predictors and outcomes. Though there were relatively few missing data overall in the present study, a SEM approach would also eliminate the need for imputation of missing values.

An additional limitation concerns how we operationalized stressors. In the present study, COVID-related stressors experienced directly by participants were assigned a higher score than stressors affecting close others in participants' lives. However, recent studies found that participants were more likely to feel anxious when someone close to them was at high risk for contracting COVID-19 relative to those who were themselves at high risk, perhaps due to increased perceived control over their own situations (Dozois, 2020; Elton-Marshall et al., 2020). Future research should consider whether to weigh the impact of stress for self vs. others in ways that take into consideration these recent findings, especially when studying the long-term effects of COVID-related stress.

Given that COVID-19 has differentially impacted demographic groups (e.g., Abedi et al., 2020; Mahajan & Larkins-Pettigrew, 2020), additional research is needed to understand how these variables may play a role in our examined outcomes. We opted not to explore the impact of demographic variables in the present study due to concerns about power*;* for example, the number of older participants was too small to investigate because the sampling was not conducted with such aims in mind. Future studies should also focus on SA individuals' relationships with the specific targets of their affiliative efforts, the goals behind

their engagement in affiliative behaviors, how these may have shifted longitudinally. Finally, our study focused primarily on affiliative behaviors that were compliant with COVID-related restrictions; future research may fruitfully include a broader assessment of changes in social contact across varying levels of compliance, especially as widespread vaccinations continue and lead to increased variability in the use of public health guidelines.

Despite these limitations, results of the present study indicate that the COVID-19 pandemic has posed unique challenges to those who retrospectively reported high levels of SA in the year prior to the pandemic, and especially those with higher pre-pandemic anxiety-related functional impairment and greater exposure to COVID-related stressors. In sum, although socially anxious individuals during the pandemic's first wave reported that they were engaging in a greater number of affiliative behaviors, their increased levels of anxiety, loneliness, and fear of negative evaluation suggest that they were experiencing significant functional impairment despite the "safe cover" of pandemic-related restrictions. Our results suggest that highly impaired, high SA individuals have been as lonely and fearful as ever during the pandemic, bringing into question the true efficacy of their affiliative behaviors in fulfilling their social needs, and perhaps signalling a greater need for social support. Future research is required to continue tracking the outcomes of this vulnerable group as the pandemic evolves and the post-pandemic era begins to identify the factors that may promote and inhibit treatment seeking, access, and utilization.

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Table 1

Sample Demographic Characteristics

Variable	Participants, *n* (%)
Country	
USA	470 (96.3%)
Canada	18 (3.7%)
Age	
18-24	56 (11.5%)
25-39	274 (56.1%)
40-59	128 (26.2%)
60+	46 (9.4%)
Gender	
Female	234 (48.0%)
Male	249 (51.0%)
Non-binary	3 (0.6%)
Other	2 (0.4%)
Ethnicity	
White	292 (59.8%)
Black	92 (18.9%)
Asian	60 (12.3%)
Hispanic Latino	18 (3.7%)
Non-Hispanic Latino	3 (0.6%)
Native American	3 (0.6%)
Multiracial	15 (3.1%)
Other	6 (1.2%)
Income	
< $20,000	94 (19.3%)
$20-49,999	162 (33.2%)
$50-74,999	114 (23.4%)
$75-99,999	73 (15.0%)
$100-149,999	34 (7.0%)
>$150,000	11 (2.3%)
Education	
Graduated high school or high school grade equivalent	33 (6.8%)
Part college or university	56 (11.5%)
Graduated 2 year college or university	43 (8.8%)
Graduated 4 year college or university	228 (46.7%)
Part graduate/ professional school	33 (6.8%)
Completed graduate/ professional school	95 (19.5%)
Relationship status	
Married or cohabiting	300 (61.5%)
Committed relationship	53 (10.9%)
Dating	16 (3.3%)
Not dating or married/cohabiting	119 (24.4%)

Table 2

Descriptive Statistics for Study Variables

Variable	Mean	SD	Min	Max	Possible range
1. Pre-pandemic social anxiety (SIAS)	25.86	19.28	0	68	0 – 68
2. Pre-pandemic functional impairment (SDS)	7.48	7.65	0	27	0 – 30
3. COVID-related stressors (CSS)	3.42	2.78	0	12	0 – 12
4. Coronavirus anxiety (CAS)	6.75	4.80	3	23	0 – 20
5. Frequency of preventive measures	20.13	3.38	8	25	5 – 25
6. Affiliative frequency and connection	31.19	9.60	12	56.5	12 – 60
7. Emotional response to affiliation	4.53	6.81	-19	24	-24 – 24
8. Δ fear of negative evaluation (BFNE)	-0.37	10.15	-36	36	-36 – 36
9. Loneliness (3-Item Loneliness Scale)	5.27	1.90	3	9	3 – 9

Note. SIAS = Social Interaction Anxiety Scale, SDS = Sheehan Disability Scale, CSS = Coronavirus Stressor Survey, CAS = Coronavirus Anxiety Scale, BFNE = Brief Fear of Negative Evaluation Scale

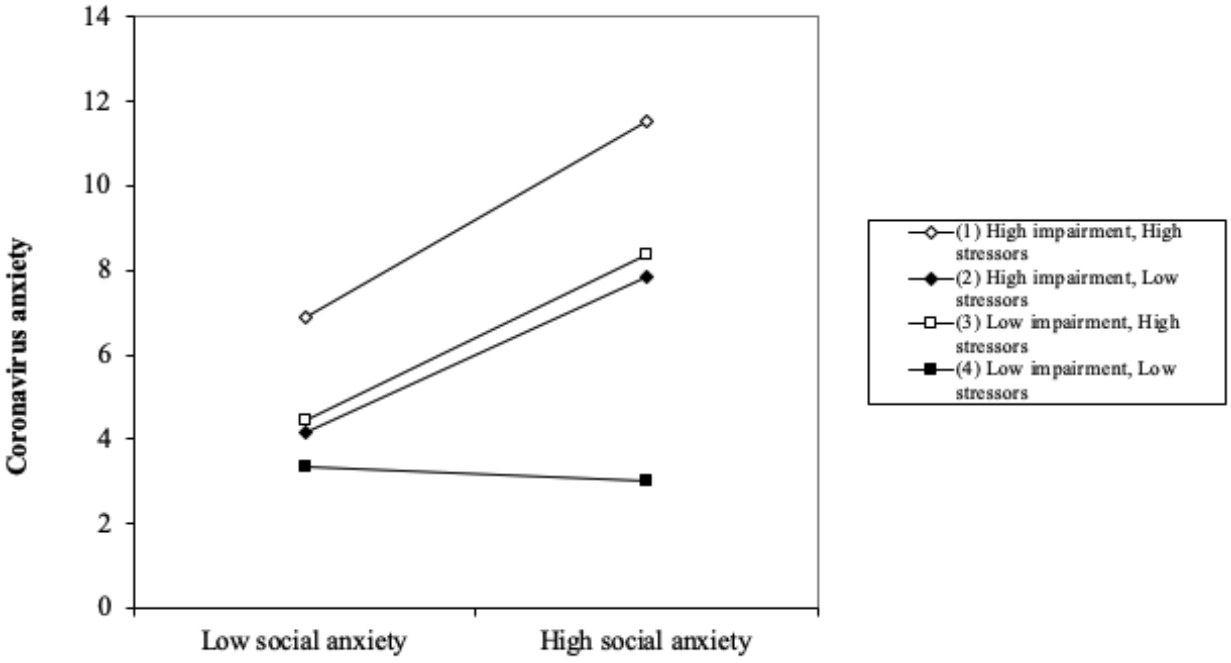

Figure 1. The moderating effects of pre-pandemic impairment and COVID-related stressors on the relationship between pre-pandemic social anxiety and coronavirus anxiety.