# Loneliness and Depressive Symptoms during the COVID-19: the Role of Rumination

**Yuting Ding**

School of Art and Science, Rutgers University, New Brunswick, US

yutingding98@163.com

**Keywords:** Loneliness, Rumination, Brooding, Depression, Reflection, COVID-19

**Abstract:** Quarantine is implemented to avoid the spread of the coronavirus, while this act may increase people's feeling of loneliness and depression. College students as a vulnerable group facing the dramatic change of social interaction are mainly studied. There are three objectives in this study. Firstly, we examine the relationship between loneliness and depression during COVID-19. Secondly, we examine the mediating and moderating role of rumination and its subtypes (i.e., brooding and reflection) in linking loneliness and depression. Third, we examine the role of gender in loneliness, rumination and depression. Method: 1258 participants that are mostly college students participated in any anonymous online survey. Results: Structural equation modeling showed that loneliness was correlated to depression during COVID-19 even after accounting for levels of loneliness before COVID-19. The relation between loneliness and depression was significantly mediated by both brooding and reflection, such that higher levels of loneliness during COVID-19 was associated with increased brooding and reflection which was directly related to higher levels of depression. Regression analysis showed that brooding and reflection moderated the loneliness-depression link, such that the association between loneliness and depression was attenuated for individuals with lower levels of rumination. While gender was not associated with depression severity, although females had higher rumination than male. Conclusion. Rumination is a critical risk factor for individuals who are most vulnerable during the COVID-19 pandemic.

## 1. Introduction

Based on the fast and inconspicuous spreading of COVID-19, the best way to prevent the spreading is to limit face-to-face contact with others [1]. Thus, quarantine is enforced or voluntarily acted out and proven to be effective [2]. However, the dramatic lifestyle change could lead to people's different mental reactions. For example, Holmes and colleagues [3] did a survey and found that people feel lonelier and more depressed during the COVID-19 pandemic. Moreover, while most people are affected by quarantine, the college population is a particularly vulnerable group because most college students are facing drastic reductions in daily social interaction. Moreover, the severity of depressive symptoms is strongly correlated with suicidal ideation in college students. [4-5]. Therefore, these findings highlighted the importance of examining changes in loneliness and its associations with depression severity (including suicide ideation) in college populations.

While Understanding the relationship between the change of loneliness and depressive symptoms is significant, it is also essential to identity the factors that affect the relationship, which may facilitate the identification of college populations that are the most at risk for maladjustment problems and target for intervention. Rumination has been proposed to be an important emotion regulation strategy that may explain the relationship between loneliness and depression. However, few studies have examined the mediating and moderating role of rumination on changes of loneliness and depression severity, especially during the pandemic. Therefore, the goal of our study is to examine the relationship between loneliness and depression in a large sample of college students during the COVID-19 pandemic, in which rumination and its subtypes of brooding and reflection as mediator and moderators. We also examined the role of gender. Below we briefly describe prior literature and gaps remaining to be addressed.

  DOI: 10.25236/medsbe.2020.014

## 2. Literature Review

### 2.1 Associations between Loneliness and Depression

The association between loneliness and depression has been well-established [6-10]. In addition to that, there is a strong relationship between severity of depression and suicidal ideation among college students. As stated before, college students are a group of people who are generally socially active and experienced dramatic change in social interaction during the pandemic. Therefore, our first aim was to examine the associations between change of loneliness due to the COVID-19 pandemic and depression severity (including suicide ideation) in a large college sample.

### 2.2 The Mediating and Moderating Role of Rumination between Loneliness and Depression

While most previous studies have established the link between loneliness and depression, the underlying mechanisms linking loneliness and depression are understudied. Also, there is a vast heterogeneity in how individuals react to quarantine, highlighting the importance of examining factors that may explain individual differences in mental health outcomes during the quarantine period. Rumination - a coping method that is characterized by self-reflection [11] repetitively and passively focusing on negative emotions [12] - has been proposed as an important factor associated with depression. However, there are mixed findings on whether rumination serves as a mediator, moderator or both between the loneliness and depression. [13-15]. Several reasons may in part explain these mixed findings. First, recent studies suggested that rumination could be divided into two subtypes: brooding and reflection. Brooding is a “passive, judgmental pondering of one’s mood”, whereas reflection is an intentional and contemplative pondering of one’s mood that is aimed to solve the problems [16]. Raes and Hermans [17] found that the mediating role between loneliness and depression of rumination would be attributed to the brooding component of rumination, rather than to the reflective rumination subtype. However, few studies have simultaneously examined the unique and differentiated role of brooding and reflection on the loneliness-depression association. Second, most studies relied on relatively small sample size and thus might have insufficient power to test for the differentiated role of brooding and reflection. Therefore, our second and third aims were o test the mediating and moderating role of rumination, respectively. Specifically, we examined whether different subtypes of rumination (i.e., brooding and reflection) functioned as a mediator or moderator between change of loneliness and depressive severity during COVID-19.

### 2.3 The Role of Gender

According to the data from the National Comorbidity Survey (NCS), women are approximately 1.7 times as likely as men to report a lifetime history of Major Depressive Episodes [18]. And based on the meta-analysis did by Johnson and Whisman [19], women have higher rates of rumination, brooding and reflection than men. In terms of loneliness, males have been found having higher loneliness scores while women are more frequently being lonely [20]. And among the college students who seek counseling, males tend to be significantly higher in loneliness while females are more likely to suffer depression. Although there are obvious gender differences that exist in the way that different populations feel about loneliness, depressive symptoms and how they ruminate, there are insufficient studies examining the role of gender in the relationship between loneliness, depression and rumination. Therefore, our fourth aim was to examine gender difference on loneliness, rumination and depression during the COVID-19 pandemic.

### 2.4 The Current Study

To address these gaps in knowledge, we used a large sample (N = 1258) of participants during the initial outbreak period of COVID-19 pandemic (April 14- May 4) in the United States. Our first aim was to examine the association between loneliness and depression severity among college

students during COVID-19 pandemic. We hypothesized that loneliness would be positively correlated with depression, even after we account for the level of loneliness before the pandemic. Our second aim was to simultaneously examine the mediating role of brooding and reflection as two different rumination subtypes linking change of loneliness and depressive severity. Based on prior studies, we hypothesized that brooding would have a stronger mediating effect than reflection on the associations between loneliness and depressive symptoms. Our third aim was to examine the moderating role of rumination on the loneliness-depression associations. We hypothesized that individuals with the effect of loneliness on depression symptoms would be stronger among individuals who are more likely to ruminate (compared to those who have lower levels of rumination). Finally, we examined the role of gender on loneliness, rumination and depression symptoms. We hypothesized that women have higher levels of loneliness, rumination, and depression compared to men.

## 3. Method

### 3.1 Participants and Procedure

Our sample of 1274 participants (867 females, 393 males, 9 others, 5 missing) were mainly college students who were recruited from a large Mid-West university in the United States through an anonymous online survey during the initial outbreak period of COVID-19 pandemic (April 14-May 4) in the United States. 3% (38) of our participants are international students. Participants were age 17 to 52 with highest education levels from high school/GED to professional degree (JD, MD). 63.9% of our participants were Caucasian, 2.7% African American, 3.1% Latino, 13.6% Asian, 7% of mix race, and 1.4% others. People who indicated their gender as "others" meant they are transgender or non-confirmative participants, and those were not included in this study. Because one of the aims of this study is to understand gender differences on isolation, rumination and depression, and we did not have sufficient N to examine participants who self-identified as transgender and non-confirmative.

After data cleaning, the final sample consisted of 1258 participants (866male, 392male, range=17-52). Participants were age 17 to 52 with the highest education levels from high school/GED to a professional degree (JD, MD). 64.1% of our participants were Caucasian, 2.7% African American, 3.1% Latino, 13.9% Asian, 4.8% of mix race, and 1.4% others.

### 3.2 Measures

Loneliness. Loneliness was measured using the Three-Item Loneliness Scale and we modified the instruction to examine both loneliness before and after the initial outbreak of COVID-19. This scale began by selecting items from the R-UCLA Loneliness Scale [21] and finding the three items with the highest loading with the exploratory and confirmatory factor analyses. Specifically, participants were asked to report how often they feel "lack of companionship", "left out" and "isolated from others" before the outbreak of COVID-19. Participants also reported how they felt with the same three items after the COVID-19 outbreak. Response categories ranged from 1 (hardly ever), 2 (some of the time) to 3 (often). The Three-Item Loneliness Scale ($\alpha$pre= .814, $\alpha$post = .748) showed good reliability, consistently with prior studies showing good reliability, concurrent and discriminant validity [22]. For the sake of clarity, loneliness assessed before and after the outbreak of COVID-19 were described as loneliness-pre and loneliness-post, respectively. Higher scores indicated higher levels of loneliness.

Depressive symptoms. The ninety-nine item of the expanded version of Depression and Anxiety Symptoms [23] provides different assessments of depression and anxiety symptoms that best describes the experiences of participants during the past two weeks from the day they did the survey. Twenty items were categorized into the broad scale, Great Depression (reliability= .886). This scale consisted of 10 items from the Dysphoria subscale (I had little interest in my usual hobbies and activities) ($\alpha$= .889) and 2 items each from the Suicidality (I had thoughts of suicide)($\alpha$= .831) ,

Lassitude (I felt exhausted)(α= .834), Insomnia (I had trouble falling asleep)(α= .824), Appetite Loss (I did not have much of an appetite) (α= .891), and Well-Being (I looked forward to things with enjoyment) (α= .858) subscales. Higher scores indicated higher levels of depression.

Rumination. Rumination was measured using the short version of the Ruminative Response Scale [24]. This scale contains 10 items from the original list of 22 that is developed by Nolen-Hoeksema and Morrow . The short version is highly correlated with the full version (r = .90) because the 10 items are selected from items that had the highest item-total correlations with the total score. And this version also has a high level of internal reliability (α = .95). Each score in this scale is ranged from 1 ("almost never") to 4 (almost always") on a 4-point Likert scale. Treynor and her colleges have described reflection items as 'neutrally valenced' because they described the behavior of engaging in contemplation to alleviate negative emotions. For example, the included items are 'Write down what you are thinking and analyze it' and 'Go someplace alone to think about your feelings''. On the other hand, the items of the Brooding described 'moody pondering' and reflected negative feelings like 'Think "Why do I always react this way?" and 'Think "Why do I have problems other people don't have?". The inter-item reliability of the Reflection subscale was .81. For the Brooding subscale, inter-item reliability of the Brooding subscale is .81.

Personality traits. Given that personality trait of emotional stability may be related to the levels of loneliness and depression, emotional stability was included as a covariate. Emotional stability was assessed using 2 items from the Ten Item Personality Measure (TIPI). The instruments reached adequate levels in terms of (a) convergence with widely used Big-Five measures in self, observer, and peer reports, (b) test-retest reliability, (c) patterns of predicted external correlates, and (d) convergence between self and observer ratings. Items were answered on a 7-point Likert-type scale, ranging from 1 (Disagree strongly) to 7 (Agree strongly) [25]. The reliability of the subscale was moderate (α= .63).

### 3.3 Analytical Plan

Pearson correlation was first conducted to examine intercorrelation of all study variables. After that confirmatory factor analysis (CFA) was conducted to examine whether different subscales of depressive symptoms can be loaded into a single latent construct of depression. To examine Aim 1 (the association between loneliness and depression severity), structural equation model (SEM) using Mplus 7.3 was conducted to examine the associations between loneliness-post (during the COVID-19 pandemic) and latent construct of depression, when accounting for the effect loneliness-pre, gender and emotion stability.

To examine Aim 2 (the mediating role of rumination), SEM was conducted by adding rumination (including both reflection and brooding subscales) in the Aim 1 model. After that MODEL INDIRECT in Mplus was conducted to examine the mediating role of rumination between loneliness and depression.

To examine Aim 3 (the moderating role of rumination), Hayes's PROCESS [26] (Model 1) in SPSS was used to examine the effect of loneliness-post, loneliness X rumination interaction on depression severity, accounting for loneliness-pre, gender and emotional stability in the model. Two Process models were conducted to examine the effect of reflection and brooding respectively. All predictor variables were mean centered prior to the analyses.

## 4. Result

Missing values of all variables range from 0 to 6 %. Little's missing completely at random test [27] was not significant, $\chi 2(89) = 126.18$, $p = .01$, which suggests that data were MCAR and that conditions were sufficient to use full information maximum likelihood (FIML) to approximate missing data for Aim 1. Mean, standard deviation (SD) and intercorrelation of all study variables are presented in Table 1.

Table 1 Mean, Sd and Intercorrelation for All Variables

| | Mean | SD | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.Loneliness (Pre) | 1.70 | .58 | — | | .15*** | .21*** | .15*** | .18*** | .18*** | -.11*** | .31*** | .243*** | -.013 | -.402*** |
| 2.Lonliness (Post) | 1.99 | .62 | .44*** | — | .26*** | .35*** | .31*** | .26*** | .14*** | -.19*** | .33*** | .31*** | .037 | -.393*** |
| 3.Appetite Loss | 1.91 | 1.11 | .14*** | .26*** | — | | | | | | | | | |
| 4.Dysphoria | 2.21 | 1.15 | .21*** | .35*** | .42*** | — | | | | | | | | |
| 5.Lassitude | 2.81 | 1.30 | .15*** | .31*** | .32*** | .45*** | — | | | | | | | |
| 6.Insomnia | 2.62 | 1.34 | .18*** | .26*** | .31*** | .33*** | .43*** | — | | | | | | |
| 7.Suicidality | 1.19 | .60 | .18*** | .14*** | .15*** | .18*** | .19*** | .13*** | — | | | | | |
| 8.Well-Being | 2.74 | 1.11 | -.11*** | -.19*** | -.14*** | -.27*** | -.18*** | -.13*** | -.07* | — | | | | |
| 9.Brooding | 2.00 | .73 | .31*** | .33*** | .25*** | .39*** | .35*** | .29*** | .33*** | -.12*** | — | | .14*** | -.39*** |
| 10.Reflection | 1.97 | .74 | .24*** | .31*** | .26*** | .33*** | .34*** | .25*** | .28*** | -.12*** | .66*** | — | .15*** | -.29*** |
| 11.Gender | 1.69 | .46 | -.01 | .04 | .09*** | .09*** | .18*** | .13*** | -.05 | -.02 | .14*** | .15*** | — | |
| 12.General Health | 3.41 | .78 | -.40*** | -.39*** | -.25*** | -.38*** | -.34*** | -.25*** | -.25*** | .29*** | -.39*** | -.29*** | -.07* | — |
| 13.Emotional Stability | 4.40 | 1.41 | -.26*** | -.24*** | -.22*** | -.31*** | -.34*** | -.28*** | -.16*** | .21*** | -.42*** | -.29*** | -.23*** | .44*** |

*Note.* * p < .05, ** p < .01, *** p < .001

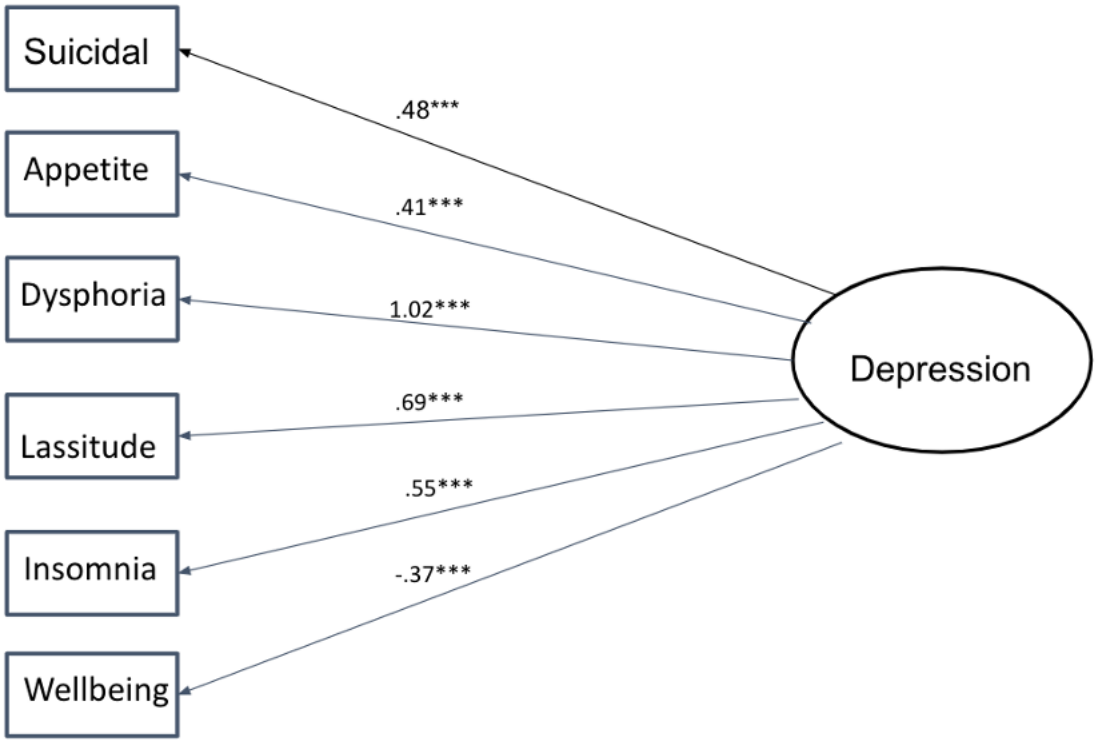


Fig.1 Cfa Model of Depression

### 4.1 Aim 1. is Change of Loneliness Associated with Depression Severity

Confirmatory factor analysis (CFA) was first employed to examine whether Suicidal, Appetite, Dysphoria, Lassitude, Insomnia, and wellbeing could be loaded as a latent construct of depression. Figure 1 illustrated a single-factor latent construct of depression, in which all factor loadings were significant. The model had a good fit: $\chi 2$ (31) = 245.839, p =.00, RMSEA = 0.07, CFI = 94 (Figure 1).

Next, SEM was used to examine the associations between change of loneliness before and during the COVID-19 pandemic and depression severity. Individuals with higher levels of pre-loneliness before the pandemic were associated with higher levels of loneliness during COVID-19 (b = .32, p < .001). Higher levels of loneliness during COVID-19 was associated with higher levels of depression (b = .28, p < .001) even after accounting for the effect of loneliness-pre in the same model. It is also found that general health was associated with depression (b=-.29, p < .001),

loneliness-post (b=-.25, p =.001), and loneliness-pre (b=-.35, p =.001). Emotional stability was not associated with loneliness-post (b=-.05, p=.098) but was related to depression (b=-.34, p=.000) and loneliness-pre (b=-.12, p=.001).

### 4.2 Aim 2. the Mediating Effect of Brooding and Reflection on Loneliness and Depression

Fig.2 Depicted the Sem Model. the Model Had a Good Fit: X2 (31) = 245.84, P =.00, Rmsea = 0.07, Cfi = .94.

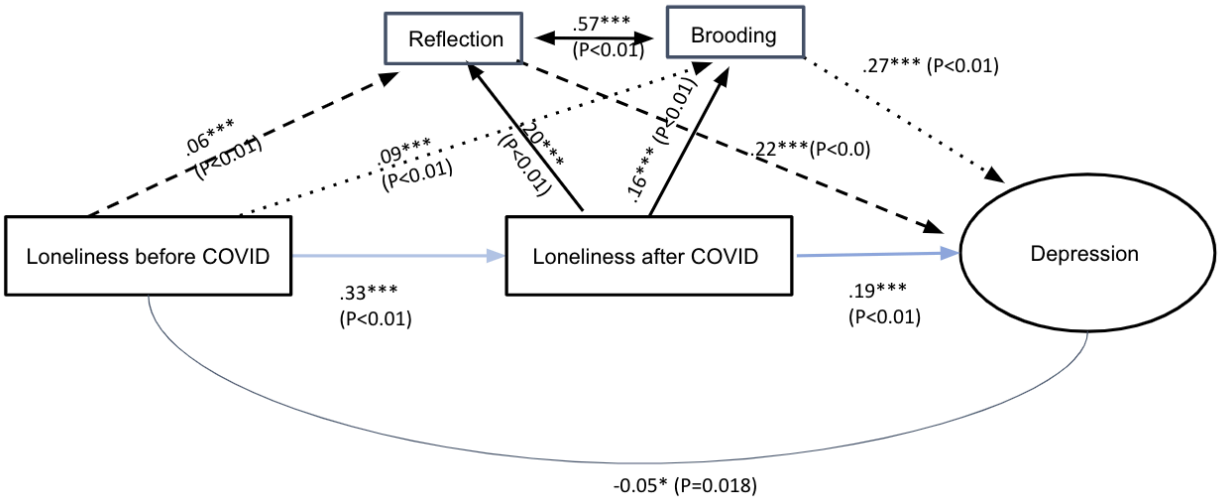


Fig.2 Sem Depicting How Loneliness is Related to Depression.

Direct and indirect pathways from loneliness to depression

Direct pathway. Higher levels of loneliness-pre was correlated with lower levels of depression (b=-.05, p<0.05). Higher levels of loneliness-post were also associated with higher levels of depression (b=.19, p<0.01).

Indirect pathways. The relation between loneliness-pre and depression was significantly mediated by loneliness-post (indirect effect: b=.06, p<.01). Specifically, higher levels of loneliness before COVID-19 was associated with increased loneliness after COVID-19 which directly related to higher levels of depression. Secondly, the relation between loneliness-post and depression was significantly mediated by both brooding (indirect effect: b=.04, p<.01) and reflection (indirect effect: b=.04, p<.01). Specifically, higher levels of loneliness after COVID-19 was associated with increased brooding and reflection which directly related to higher levels of depression. Thirdly, there was an indirect pathway of relation between loneliness-pre and depression significantly mediated by brooding (indirect effect: b=.03, p<.01) and reflection (indirect effect: b=.01, p<.05). Specifically, higher levels of loneliness before COVID-19 was associated with increased brooding and reflection which directly related to higher levels of depression. Fourthly, loneliness before pandemic-loneliness after pandemic-reflection-depression pathway (Figure 2) was observed (indirect effect: b=.01, p<.01). Moreover, higher loneliness before COVID-19 was related to higher levels of loneliness after COVID-19 which was associated with higher levels of rumination, which was associated with higher depression (indirect effect: b=.01, p<0.01).

### 4.3 Aim 3. the Moderating Effect of Brooding and Reflection on Loneliness and Depression

Brooding. As shown in Table 2, linear regression analysis revealed that there was a significant loneliness-post X brooding interaction on depressive symptoms was observed. Specifically, a stronger association between loneliness-post and depression severity was observed for participants who had higher levels of rumination (Figure 3).

Reflection. Similarly, there was a significant loneliness-post x reflection interaction on depressive symptoms (Table 3). Specifically, a stronger association between loneliness-post and depression severity was observed for participants who had higher levels of reflection (Figure 4).

Table 2 Regression Table (Brooding Interaction)

| Variables | Coefficient | Standard Error | P-value |
|---|---|---|---|
| Gender | .02 | .03 | .556 |
| General Health | -.14 | .02 | .000 |
| Emotional Stability | -.09 | .01 | .000 |
| Loneliness (Pre) | -.05 | .03 | .074 |
| Loneliness (Post) | .18 | .02 | .000 |
| Brooding | .21 | .02 | .000 |
| Reflection | .19 | .02 | .000 |
| Loneliness (Post) by Brooding | .07 | .03 | .016 |
| $R^2$ | .51 | | |

Table 3 Regression Table (Reflection Interaction)

| Variables | Coefficient | Standard Error | P-value |
|---|---|---|---|
| Gender | .019 | .03 | .500 |
| General Health | -.14 | .02 | .000 |
| Emotional Stability | -.09 | .01 | .000 |
| Loneliness (Pre) | -.04 | .03 | .092 |
| Loneliness (Post) | .18 | .02 | .000 |
| Brooding | .22 | .02 | .000 |
| Reflection | .18 | .02 | .000 |
| Loneliness (Post) X Brooding | .08 | .03 | .007 |
| $R^2$ | .51 | | |

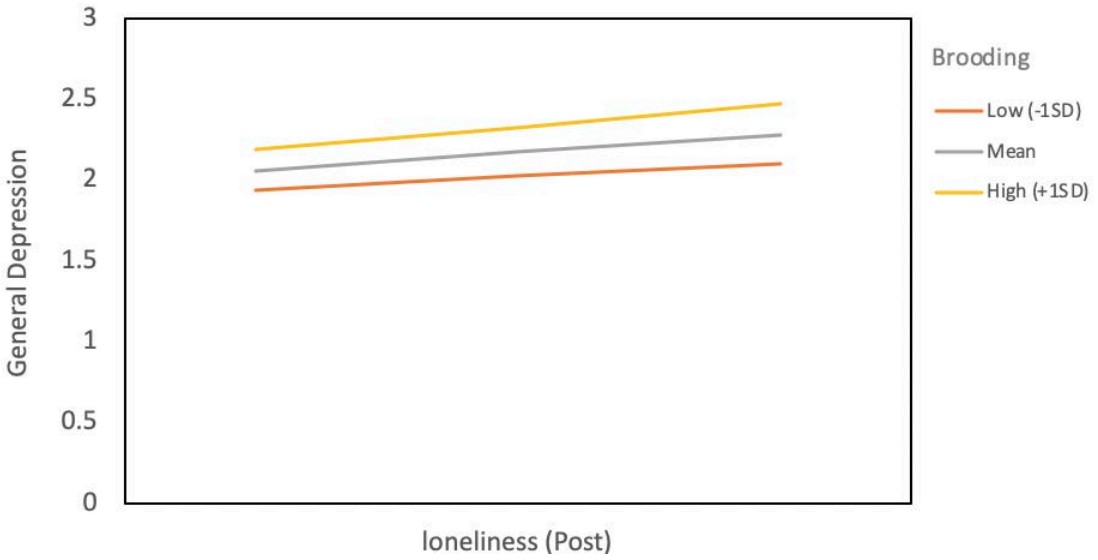


Fig.3 Moderation Analysis Model (Brooding).

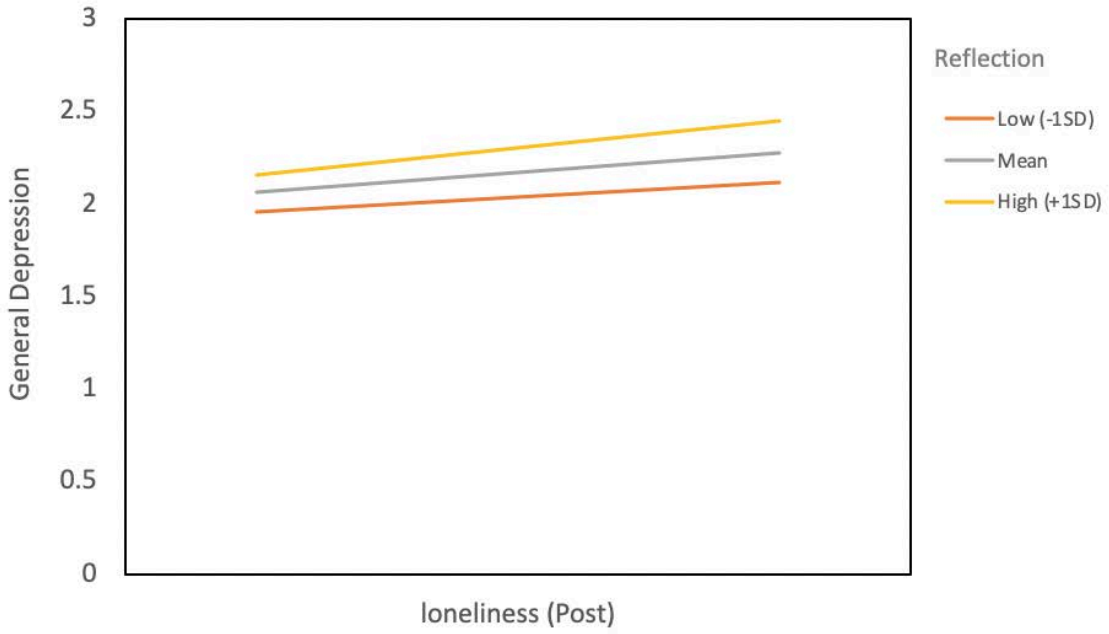


Fig.4 Moderation Analysis Model (Reflection).

### 4.4 Aim 4. Effect of Gender on the Level of Rumination, Loneliness, and Depression

SEM revealed that male have higher loneliness-pre than females (b=-.06, p=0.016), but there are no gender differences in loneliness-pre (b=.01, p=.663). Gender was not related to depression when accounting for rumination (b=-.01, p=.719). Females were more likely to ruminate for both brooding (b=.06, p=.014) and reflection (b=.10, p=.000).

## 5. Discussion

This research has four objectives. First, to examine the relationship between change of loneliness and depression severity during the COVID-19. Second, to examine the mediating role of brooding and reflection – two different types of rumination on the relationship between loneliness and depression. Third, to examine the moderating role of brooding and reflection in linking loneliness and depression. Fourth, to examine the role of gender on loneliness, rumination and depression. We found that higher levels of loneliness during the pandemic were positively associated with depression, even after accounting for the effect of loneliness before the outbreak of COVID-19. Rumination served as both mediator and moderator in the relationship between loneliness and depression. Moreover, both types of rumination (i.e., reflection and brooding) significantly mediated and moderated the loneliness- depression association. Specifically, a stronger association between loneliness and depression severity was observed for participants who had higher levels of rumination (Figure 3 and 4). Finally, males had higher levels of loneliness before the pandemic, while both genders had similar levels of loneliness during the pandemic. Gender was not related to depression after accounting for the effect of rumination, although females had higher levels of rumination.

### 5.1 Loneliness and Depression.

First, we found that there was an increase in loneliness from pre- to post- COVID-19 outbreak, which is consistent with Holmes and colleagues' review study that people felt lonelier and more depressed during the COVID-19 pandemic. Our study further extended prior studies by showing a direct association between loneliness assessed during the pandemic and depression severity, even after controlling the effect of baseline loneliness, personality trait (i.e., emotional stability) and gender. However, it is worth to note that when asked about participants' loneliness before the

pandemic, it was associated with lower levels of depression. It is possible that the social consequences of the pandemic may have a stronger effect on people who have lower baseline levels of loneliness before COVID-19. Given that a non-clinical community college sample, participants with lower levels of loneliness before the pandemic may have a drastic change in their daily lives and social interaction with others, and therefore may be particularly vulnerable for maladjustment given the unpredictable nature of this pandemic. Whereas for participants who exhibited higher levels of loneliness even before the pandemic, they may face less change of loneliness during the pandemic. While it is beyond of the scope of this study, future studies are needed to examine change in depressive severity before or during the pandemic in order to test this hypothesis.

### 5.2 The Role of Rumination

Contrary to our hypothesis that brooding would be a stronger risk factor than reflection, our findings suggest that both brooding and reflection are mediating (Figure 2) and moderating (Figures 3 and 4) the association between loneliness and depression. There are several plausible explanations. First, it is possible that the discrepancies differences in sample size. Second, the discrepancy could also be due to the time frame. Since we did not conduct a longitudinal study, we do not know whether brooding and reflection are both related to depression severity at follow-up. Prior studies have shown that brooding relative to reflection is a stronger predictor of depression at 1-year follow-up. It is necessary to examine the association between subtypes of rumination and depression severity during the pandemic at follow-up in future. Third, it is also possible that given the uncontrollable and unpredictable nature of the pandemic, simply ruminate (regardless of subtypes) increased the risk for depression. Nevertheless, our findings suggest that rumination in general is a strong risk factor in linking loneliness to depression during the COVID-19 pandemic.

### 5.3 The Role of Gender

Gender in this study is not related to depression after accounting for rumination. This is consistent with previous findings, suggesting that females are twice as likely to have depression largely due to the behavior of ruminate. The result that women are more vulnerable because they have higher rumination rate indicates that targeting rumination intervention could be a helpful strategy to reduce depression, especially for female during this COVID-19 pandemic. And the fact we did not find any gender differences in loneliness-post likely suggested that COVID-19 affects loneliness equality in both genders.

### 5.4 Strengths and Limitations

This study collected a large amount of data from over one thousand sample participants, which provides more accurate mean value and less margin of error compared to the studies that have relatively smaller sample size. And the data are collected during the first few weeks of implementing guarantee in the United States, which reflects college students' feelings and mental states in a timely manner. However, this study also has many limitations remaining to be improved. Firstly, the participants of this study are mainly Caucasians, so it is hard to generalize the findings from this study to other ethnic groups or individuals outside the United States. Secondly, this study is not a longitudinal study. Therefore the results do not tell about how the quarantine would affect college students after this pandemic, whether the correlations will continue to exist after the first few weeks of quarantine starts, and whether the mediating and moderating role between loneliness and depression will last 6 months or a year after the COVID-19. Thirdly, this study did not measure the participants' guarantee length during each day, so the increase of the feeling of loneliness and depression could be due to the pandemic itself instead of quarantine. It will be meaningful to examine whether the length of quarantine and the number of people interacted would affect participants' perception of loneliness and depression. Also, it is important to note that our result did not generalize to gender non-confirmative participants because we do not have enough samples in

our participants that are gender non-confirmative to be included in the analysis which could be examined in future.

## 6. Conclusion

Loneliness is correlated with depression during the COVID-19. Our findings have shown strong implication in targeting individuals who are the most vulnerable of higher levels of depression during the COVID-19 pandemic. In addition, our findings highlight the importance of rumination in linking loneliness and depressive symptoms, suggesting the importance of targeting rumination as a transdiagnostic intervention for individuals who are at risk for depression.

## References


[1] Centers for Disease Control and Prevention. [online] Available: www.cdc.gov

[2] Taghrir, Mohammad Hossein, Hossein Akbarialiabad, et al. “Efficacy of mass quarantine as leverage of health system governance during COVID-19 outbreak: a mini policy review.” Archives of Iranian medicine, vol. 23, no. 4, pp. 265-267, 2020.

[3] Holmes, Emily A., Rory C. O’Connor, et al. “Multidisciplinary research priorities for the COVID-19 pandemic: a call for action for mental health science.” The Lancet Psychiatry, vol. 7 no. 6, pp. 547-560, 2020.

[4] Kisch, Jeremy, E. Victor Leino, et al. “Aspects of suicidal behavior, depression, and treatment in college students: Results from the Spring 2000 National College Health Assessment Survey.” Suicide and Life-Threatening Behavior, vol. 35, no. 1, pp. 3-13, 2005.

[5] Garlow, Steven J., Jill Rosenberg, et al. “Depression, desperation, and suicidal ideation in college students: results from the American Foundation for Suicide Prevention College Screening Project at Emory University.” Depression and anxiety, vol. 25, no. 6, pp. 482-488, 2008.

[6] Vanhalst, Janne, Theo A. Klimstra, et al. “The interplay of loneliness and depressive symptoms across adolescence: Exploring the role of personality traits.” Journal of youth and adolescence, vol. 41, no. 6, pp. 776-787, 2012.

[7] Vanhalst, Janne, Koen Luyckx, et al. “Loneliness and depressive symptoms: The mediating and moderating role of uncontrollable ruminative thoughts.” The Journal of psychology, vol. 146, no. 1-2, pp.259-276, 2012.

[8] Choi, Hanbyul, Michael R. Irwin, et al. “Impact of social isolation on behavioral health in elderly: Systematic review.” World journal of psychiatry, vol. 5, no. 4, pp. 432, 2015.

[9] Wardenaar, Klaas J., Rei Monden, et al. “Symptom-specific course trajectories and their determinants in primary care patients with Major Depressive Disorder: Evidence for two etiologically distinct prototypes.” Journal of affective disorders, vol. 179, pp. 38-46, 2015.

[10] Wan Mohd Azam, Wan Mohd Yunus, Normah Che Din, et al. “Loneliness and depression among the elderly in an agricultural settlement: Mediating effects of social support.” Asia‐Pacific Psychiatry, vol. 5, pp. 134-139, 2013.

[11] Morrow, Jannay, Susan Nolen-Hoeksema. “Effects of responses to depression on the remediation of depressive affect.” Journal of personality and social psychology, vol. 58, no. 3, pp. 519, 1990.

[12] Lyubomirsky, Sonja, Nicole D. Caldwell, et al. “Effects of ruminative and distracting responses to depressed mood on retrieval of autobiographical memories.” Journal of personality and social psychology, vol. 75, no. 1, pp. 166, 1998.

[13] Zawadzki, Matthew J., Jennifer E. Graham, et al. “Rumination and anxiety mediate the effect of loneliness on depressed mood and sleep quality in college students.” Health Psychology, vol. 32, no. 2, pp. 212, 2013.

[14] Mezulis, Amy, Jordan Simonson, et al. “The association between temperament and depressive symptoms in adolescence: Brooding and reflection as potential mediators.” Cognition & emotion, vol. 25, no. 8, pp. 1460-1470, 2012.

[15] Gan, Pei, Yan Xie, et al. “Rumination and loneliness independently predict six-month later depression symptoms among Chinese elderly in nursing homes.” PLoS One, vol. 10, no. 9, pp. 1-10, 2015.

[16] Whitmer, Anson, Ian H. Gotlib. “Brooding and reflection reconsidered: A factor analytic examination of rumination in currently depressed, formerly depressed, and never depressed individuals.” Cognitive Therapy and Research, vol. 35, no. 2, pp. 99-107, 2011.

[17] Raes, Filip, Dirk Hermans. “On the mediating role of subtypes of rumination in the relationship between childhood emotional abuse and depressed mood: Brooding versus reflection.” Depression and anxiety, vol. 25, no. 12, pp. 1067-1070, 2008.

[18] Kessler, Ronald C., Katherine A. McGonagle, et al. “Sex and depression in the National Comorbidity Survey I: Lifetime prevalence, chronicity and recurrence.”, vol. 29, no. 2-3, pp. 85-96, 1993.

[19] Johnson, Daniel P., Mark A. Whisman. “Gender differences in rumination: A meta-analysis.” Personality and individual differences, vol. 55, no. 4, pp. 367-374, 2013.

[20] Borys, Shelley, Daniel Perlman. “Gender differences in loneliness.” Personality and Social Psychology Bulletin, vol. 11, no. 1, pp. 63-74, 1985.

[21] Russell, Dan, Letitia A. Peplau, et al. “The revised UCLA Loneliness Scale: concurrent and discriminant validity evidence.” Journal of personality and social psychology, vol. 39, no. 3, pp. 472, 1980.

[22] Hughes, Mary Elizabeth, Linda J. Waite, et al. “A short scale for measuring loneliness in large surveys: Results from two population-based studies.” Research on aging, vol. 26, no. 6, pp. 655-672, 2004.

[23] Watson, David, Michael W. O’Hara, et al. “Development and validation of new anxiety and bipolar symptom scales for an expanded version of the IDAS (the IDAS-II).” Assessment, vol. 19, no. 4, pp. 399-420, 2012.

[24] Treynor, Wendy, Richard Gonzalez, et al. “Rumination reconsidered: A psychometric analysis.” Cognitive therapy and research, vol. 27, no. 3, pp. 247-259, 2003.

[25] Gosling, Samuel D., Peter J. Rentfrow, et al. “A very brief measure of the Big-Five personality domains.” Journal of Research in personality, vol. 37, no. 6, pp. 504-528, 2003.

[26] PROCESS: A versatile computational tool for observed variable mediation, moderation, and conditional process modeling. [online] Available: https://www.semanticscholar.org/paper/PROCESS-%3A-A-Versatile-Computational-Tool-for-%2C-%2C-1-Hayes/862dd61cccad6b39ffe890557db19a6356bbe8ca

[27] Little, Roderick JA. “A test of missing completely at random for multivariate data with missing values.” Journal of the American statistical Association, vol. 83, no. 404, pp. 1198-1202, 1988.