The impact of non-infection pandemic stress on depression and anxiety severity: Investigating mediation by intrusive and deliberate rumination

Scott D. Squires [a,*], Mianzhi Hu [b], Roumen V. Milev [a,b,c], Jordan Poppenk [a,b,d]

[a] Centre for Neuroscience Studies, Queen's University, Kingston, Ontario, Canada
[b] Department of Psychology, Queen's University, Kingston, Ontario, Canada
[c] Department of Psychiatry, Queen's University, Kingston, Ontario, Canada
[d] School of Computing, Queen's University, Kingston, Ontario, Canada

A B S T R A C T

Background: Social restrictions to curb COVID-19's spread have had adverse effects on population mental health. Rumination is one mechanism through which pandemic stress (PS) might translate into psychopathology. In particular, intrusive rumination (IR) is believed to be problematic. In this study, we investigated whether IR and deliberate rumination (DR) mediated the associations between PS and both depression and anxiety severity.
Methods: 1090 participants recruited online and from an undergraduate psychology participation pool completed an assessment of COVID-19 PS, as well as the Event-Related Rumination Inventory, the Beck Depression Inventory-II, and the Beck Anxiety Inventory. Total scores for PS, IR, DR, depression, and anxiety severity were tested in a parallel mediation model.
Results: PS positively predicted IR, DR, depression, and anxiety severity. IR positively predicted 1depression and anxiety severity, whereas DR did not. Indirect effects of PS on depression and anxiety severity were significant for IR, but not DR. Direct effects of PS on anxiety and depression severity were significant. Taken together, IR partially mediated the association between PS and both measures of psychopathology, and DR did not.
Limitations: This study was limited by its cross-sectional design and the lack of assessment of when PS exposure occurred.
Conclusions: Regarding PS that is unrelated to infection by COVID-19, IR is one mechanism through which psychopathology may emerge, whereas DR appears to be benign. Promoting a shift from IR to DR may therefore be one strategy for mitigating the negative effects of PS and other stressors on mental health.

1. Introduction

Social restriction measures enacted to safeguard public health during the coronavirus disease 2019 (COVID-19) pandemic (e.g., business closures, working from home, physical distancing, etc.) have adversely impacted the mental health of people worldwide. This is evidenced by a rise in depression, anxiety, post-traumatic stress (PTS), substance misuse, and other psychiatric symptoms; even among uninfected individuals (Krishnamoorthy et al., 2020; Rogers et al., 2020). It is important to understand the mechanisms of these impacts to better anticipate, weigh and address the unintended negative consequences of public health policy. Rumination, defined broadly as repetitive thinking about discrepancies between current and desired states or situations (Smith and Alloy, 2009), is a cognitive mechanism through which stress

may translate into psychopathology (Robinson and Alloy, 2003), and is therefore important to investigate in this context.

By maintaining aversive, personally relevant thoughts in working memory, rumination can initiate and maintain the stress response (Brosschot et al., 2006), chronic activation of which has negative mental health effects that include increased risk and severity of depressive and anxiety disorders (Monroe and Harkness, 2005; Wardenaar et al., 2014). Whether this mechanism helps explain the pathway between pandemic stress (PS) and internalizing psychopathology (Krishnamoorthy et al., 2020; Rogers et al., 2020), however, has gone largely uninvestigated in the PS literature to date (Squires and Hu, 2021). This dearth in research is in spite of individual cognitive processes, including rumination, being easier to target via psychosocial interventions (e.g., rumination-focused cognitive behavioural therapy, RFCBT; Watkins et al., 2011) than whole

syndromes like depression or PTS.

Further, the degree to which rumination is voluntary appears to be relevant to mental health impacts: for instance, many studies have observed that involuntary and aversive repetitive thinking about an event (i.e., intrusive rumination; IR) is associated with PTS symptoms. In contrast, deliberate rumination (DR) about the same event, despite leading to PTS symptoms as well in some cases (e.g., Zhou and Wu, 2016), is usually linked with positive mental health outcomes such as post-traumatic growth (PTG; e.g., Cann et al., 2011). Indeed, a well-supported model of PTG by Tedeschi and colleagues (e.g., Calhoun et al., 2010) has much evidence that both IR and DR occur in response to stressful experiences, that greater IR (and sometimes DR) is linked with worse short-term PTS symptoms, and that DR in particular is linked with improved long-term mental health recovery via PTG and related processes. Although these associations have been well-established, researchers have yet to thoroughly investigate if the mental health outcomes predicted by the PTG model also apply to symptoms of depression and anxiety. Additionally, IR and DR have yet to be investigated as mediators that may explain the link between PS and these internalizing symptoms.

We sought to improve our understanding of PS, rumination, and internalizing psychopathology by exploring in an online sample of participants whether IR and DR about the pandemic mediated the associations of PS with depression and anxiety. It is worth noting that the kinds of stress experienced due to pandemic-related social restrictions are quite different from the kinds of traumatic stress involved in most studies that investigate event-related rumination (e.g., natural disasters, exposure to war or occupational hazards, etc.). Traumatic stressors are usually acute occurrences, for instance, with rumination about one's experience happening typically after that experience has concluded. In contrast, PS is chronic, with rumination about one's experience occurring while the stressor is on-going with an uncertain endpoint. In spite of these differences between traumatic stress and PS, we hypothesized that IR about the COVID-19 pandemic would positively mediate the associations of PS with depression and anxiety severity, similarly to how rumination about traumatic experiences is known to increase symptoms of PTS (e.g., Cann et al., 2011). This hypothesis is supported by the acknowledgment of Calhoun et al. (2010) that IR aligns conceptually with depressogenic (and anxiolytic; McEvoy et al., 2013) forms of rumination defined in Response Styles Theory (Nolen-Hoeksema et al., 2008) and Processing Mode Theory (Watkins, 2008).

Additionally, since DR is sometimes associated with both negative and positive mental health outcomes, stress symptoms and stress-related growth, respectively (e.g., Zhou and Wu, 2016), we hypothesized that DR would significantly mediate the associations of PS with depression and anxiety severity; however, we were agnostic as to the directions of these mediation effects. This hypothesis is supported again by Calhoun et al. (2010), who acknowledge that the trajectory of DR's effects on internalizing psychopathology is similar to that of other forms of voluntary, reflective rumination which are known to have short-term depressogenic and long-term protective associations (e.g., Treynor et al., 2003). If DR is found to positively mediate the PS-psychopathology link, this could suggest that for our sample not enough time has passed since PS's impact for DR to be able to produce mental health benefits (e.g., PTG). In contrast, if DR is found to buffer (i.e., negatively mediate) this link, it could suggest that a large portion of our sample has had sufficient time and resources to cope with their PS, such that engaging in DR could sufficiently produce its adaptive outcomes.

2. Method

2.1. Participants and procedure

This study was approved by the General Research Ethics Board at Queen's University. This study utilized an online convenience sample of 1533 participants recruited from Reddit ("r/samplesize" subreddit; $n = 748$), Facebook (e.g., first author's personal page, "Kingston Shameless Promotion", "Survey Exchange/Survey Group/Survey Participants – Dissertation, Thesis", "Psychology and Neuroscience", and similar groups; $n = 180$), and the undergraduate psychology participation pool at Queen's University ($n = 605$). These participants' data were collected as part of a larger study about rumination, which was conducted via Qualtrics survey platform. Participants' data were excluded if they indicated that they or a family member had ever contracted COVID-19. This is because we wished to avoid conflating the unknown cognitive effects of COVID-19 infection, as well as the effects of heightened infection fear and stress from living with an infected loved one, with the effects of the most commonly experienced forms of PS (i.e., government-mandated social restrictions). A total of 443 participants reported that they or a family member had a history of COVID-19 infection, and thus data from 1090 participants remained in the analysis. Participants' demographic and clinical information is presented in Table 1.

2.2. Measures

PS was assessed with the COVID-19 Impact Scale, which has 16 items focused on four domains: COVID-19 infection (of oneself or family), social restrictions, impact on daily life (e.g., education, employment), and supply shortages (e.g., food, medication; Howes Vallis et al., 2021). Item scores ranged from 1 (No impact) to 5 (Severe impact). Responses other than "no impact" on the self or family COVID-19 infection items excluded that participant's data from analysis. The remaining 14 item scores were summated to establish each participant's PS score. The COVID-19 Impact Scale had a good internal consistency in our sample (Cronbach's $\alpha = 0.82$).

Pandemic-related rumination was measured using a modified

Table 1
Demographic and clinical information of sample.

Demographic/clinical variable	Percentage (n = 1090)
Age (years)	
16–25	69.1
26–35	20.4
36–45	6.9
46–55	1.8
>55	1.8
Female	74.7
Race/Ethnicity	
Caucasian	64.0
Asian	20.4
African	2.4
Hispanic	1.7
Other	11.5
Marital status	
Single (never married)	57.7
Dating	24.0
Common law	4.2
Married	10.8
Divorced/Separated	1.9
Other	1.2
Occupational status	
Student	59.2
Unemployed	8.1
Part-time	16.4
Full-time	23.7
Other	7.2
Depression Severity	
None	46.0
Mild	16.1
Moderate	17.5
Severe	20.4
Anxiety Severity	
None	48.1
Mild	26.5
Moderate	15.0
Severe	10.4

version of the Event-Related Rumination Inventory (ERRI; Cann et al., 2011). The ERRI includes 20 items divided evenly between its two subscales: DR (e.g., "I think about whether I can find meaning from the event") and IR (e.g., "I think about the event when I do not mean to"). Item scores ranged from 1 (Not at all) to 4 (Often). The ERRI was modified for the present study to assess rumination about the COVID-19 pandemic specifically. This was accomplished by including instructions that refer to thoughts about the pandemic and by rephrasing items to reference "…the pandemic and its consequences…", instead of "…the event…". In our sample, the internal consistencies of the DR and IR subscales were good and excellent, respectively (Cronbach's α = 0.89 (DR) and 0.94 (IR)).

Depression and anxiety severity were measured using the Beck Depression Inventory-II (BDI-II; Beck et al., 1996) and the Beck Anxiety Inventory (BAI; Beck et al., 1988), respectively. Each scale has 21 items, with scores ranging from 0 to 3, that assess their respective symptoms of depression (e.g., sadness, pessimism, loss of pleasure, etc.) and anxiety (e.g., unable to relax, feeling nervous, shaking, etc.). For the BDI-II, scores of 14–19, 20–28, and 29–63 suggest mild, moderate, and severe depression, respectively, whereas scores of 8–15, 16–25, and 26–63 on the BAI suggest those respective severity levels of anxiety. Both the BDI-II and BAI had excellent internal consistencies in our sample (Cronbach's α = 0.93 (BDI-II) and 0.93 (BAI)).

2.3. Analysis

We tested a parallel mediation, multiple outcome model using MPlus. Confidence intervals for the indirect effects were estimated based on bias-corrected bootstrap resampling of 10,000 samples. PS score was the predictor, DR and IR scores were the mediators, depression and anxiety severity scores were the outcome variables, and age and sex were included as covariates (Model 1; illustrated in Fig. 1; see also Supplementary Materials for possible alternative Models 2 and 3).

3. Results

Presented in Fig. 1 are the standardized beta coefficients, correlation coefficients, and bootstrapped bias-corrected 95% confidence intervals for the effects of the hypothesized model. The total effects of PS on depression and anxiety severity were significant. Regarding direct effects, higher PS predicted higher DR and IR ratings. Additionally, higher IR, but not DR predicted more severe depression and anxiety. Tests of indirect effects indicated that IR mediated the associations between PS and both depression ($\beta = 0.11$, $p < .001$, 95% CI: 0.07 to 0.15) and anxiety severity ($\beta = 0.13$, $p < .001$, 95% CI: 0.09 to 0.17), explaining 31% and 33% of their respective direct effects, whereas DR did not mediate these associations (Depression: $\beta = -0.02$, $p = .36$, 95% CI: -0.05 to 0.02; Anxiety: $\beta = 0.01$, $p < .59$, 95% CI: -0.03 to 0.05). After controlling for indirect effects, the direct effect of PS on depression and anxiety remained significant, indicating a partial mediation by IR. This model explained 26.5%, 26.9%, 16.6%, and 24.0% of the variance in DR, IR, depression, and anxiety scores, respectively (see Supplementary Materials for results of alternative models).

4. Discussion

Our data confirms that non-infection PS is associated with more severe depression and anxiety as well as both forms of event-related rumination assessed, IR and DR. Additionally, IR was found to be a partial mediator for the associations between PS and both depression and anxiety severity. In contrast, DR, although predicted by PS, was not shown to mediate either of the two direct effects. These findings have support from previous research investigating IR and DR about stressful experiences and their relations to psychopathology. During the development of the ERRI, Cann et al. (2011) found that IR predicted PTS symptoms, but not PTG, whereas the opposite was true for DR. Since developing the ERRI, these associations have been observed across many populations and kinds of stressful events (e.g., García et al., 2017; Lancaster et al., 2015); however, many studies have found that DR predicts PTS in addition to growth (e.g., Zhou and Wu, 2016).

A handful of studies have investigated IR and DR during the COVID-19 pandemic specifically. In a region of South Korea where the country's first major outbreak occurred, Kang and Kim (2021) found that IR, and not DR was associated with PTS symptoms. In a sample of frontline
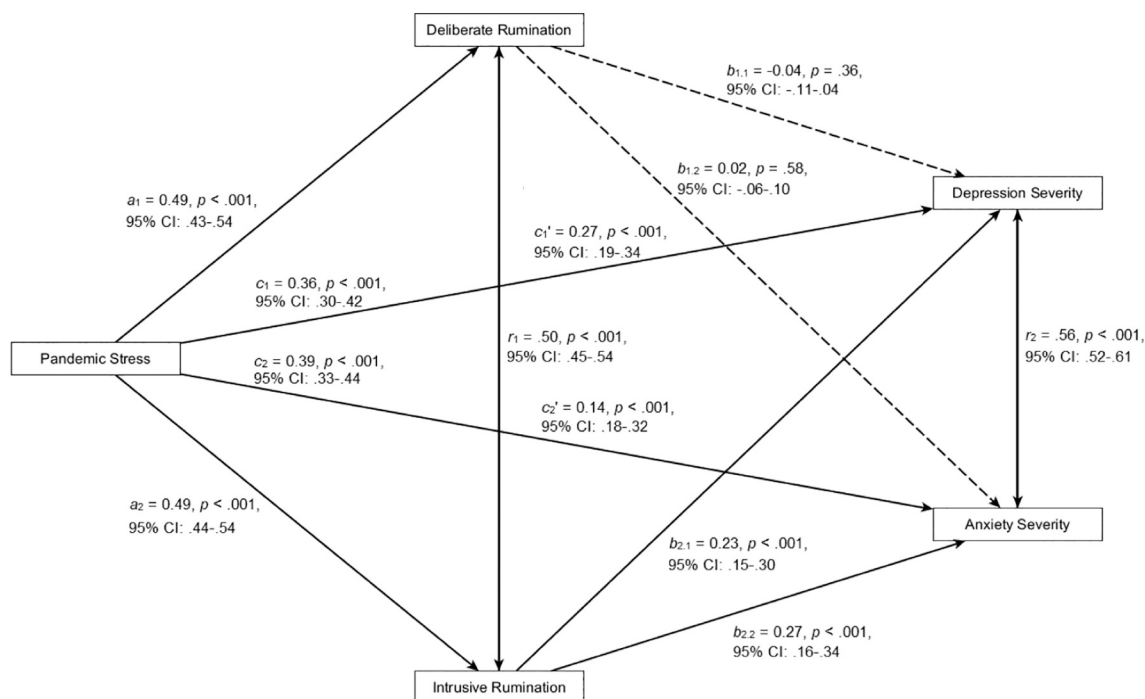

Fig. 1. Multiple mediation model illustrating partial mediation of the effect of non-infection pandemic stress on depression and anxiety severity by intrusive rumination (Model 1; see Supplementary Materials for alternative models).

nurses, Cui et al. (2020) found that DR predicted PTG, whereas IR did not. Ikizer et al. (2021) found that IR and DR each predicted PTS symptoms and post-traumatic depreciation (i.e., negative aspects of post-traumatic change; Cann et al., 2010), but only DR predicted PTG. With these results in conjunction with our own, it becomes clear that rumination about the COVID-19 pandemic, particularly IR, not only increases symptoms of PTS, but the severity of internalizing psychopathology more broadly.

Only a few studies have investigated depression severity as outcomes of IR and/or DR, although none are in relation to the COVID-19 pandemic. In a longitudinal study of adolescents, both IR and DR mediated the relations of cyberbullying victimization and depression severity, but only IR mediated the path to PTS severity (Liu et al., 2020). In adolescents one year after the experience of a deadly earthquake, higher IR scores were linked to increased odds of PTS and/or depression, whereas higher DR scores were linked to decreased odds of depression (Qi et al., 2020). Finally, in a sample of holocaust survivors, IR positively and DR negatively mediated the association between PTS and depression severity (Greenblatt-Kimron and Cohen, 2020). Our findings are the first to demonstrate that IR, not DR, mediates the link between PS and depression symptom severity.

We also discovered that these associations hold for anxiety severity, despite controlling for depression severity. We believe this is the first time that associations between event-related rumination and non-PTS anxiety severity have been observed or even tested. This observation is evidence that the associations with anxiety that many kinds of rumination have (e.g., brooding, emotion-driven, global, and reflection; Olatunji et al., 2013) can also be said to apply to IR, but not DR.

Taken together, it is clear that IR and DR are different in terms of their associations with negative mental health outcomes. It appears that regardless of the kind of stress involved, IR predicts and mediates paths to worse symptoms of psychopathology. For DR, some studies suggest that it is linked with worse mental health, while many others show that it can lead to PTG and other positive mental health outcomes (e.g., reduced risk of depression). An explanation for this is that stressful experiences lead directly to disruptions of core beliefs as well as IR about the stress (e.g., Choi and In, 2020), which is usually a distressing and upsetting experience. DR increases in response to this as one tries to understand their experience and adapt their core beliefs to accommodate new information, which leads to PTG (Ogińska-Bulik, 2016) even if that experience is still somewhat distressing and thus increases PTS (e.g., Zhou and Wu, 2016). This increase in PTG provides a psychological buffer that has been shown to reduce risk of depression longitudinally (Qi et al., 2020).

Unlike previous research, our study showed that DR was not associated with severity of psychopathology. This can perhaps be explained by individual differences in the interval between experiencing PS and participating in the study. It is likely some individuals participated soon after PS, when DR would likely be associated with greater symptoms of psychopathology because stress-related growth has yet to occur. Others may have participated long after PS, providing time for growth to enact its positive effects on mental health. Unfortunately, we did not assess this interval. Future research on this topic may benefit from doing so, and potentially scheduling assessments after a defined interval following PS.

Also, it should be noted that we employed a cross-sectional design. Although such a design is common in the event-related rumination literature, it still cannot establish causal directions of effects. Indeed, alternative models with different configurations of predictors, mediators, and outcomes fit the data just as well as our hypothesized model (see Supplementary Materials; Average R^2 of 23.5%, 23.0%, and 23.5% for dependent variables of the hypothesized model and two alternative models, respectively). This leaves open the alternative interpretation that anxiety mediates the link between PS and both DR and IR; or that IR mediates the associations that depression and anxiety have on PS. Measuring these variables at multiple timepoints would allow assessment of which causal model is most valid. That said, we are confident the hypothesized model is valid, given that many studies have established longitudinally that rumination after stress exposure predicts later psychopathology (e.g., Zhou and Wu, 2016).

In conclusion, not all forms of rumination are responsible for mediating the association between non-infection PS and psychopathology. Although PS is associated with greater IR and DR, it is IR that accounts for some of PS's links to depression and anxiety, not DR. This suggests that IR is a worthy target for intervention in individuals who have suffered PS, and attempts to shift to DR instead may mitigate rumination's negative mental health effects. Indeed, this recommendation is very similar to how RFCBT (Watkins et al., 2011) operates, which involves the treatment of unconstructive forms of rumination (similar to IR; Cann et al., 2011), in part by encouraging engagement in constructive forms of rumination (similar to DR; Cann et al., 2011).

CRediT authorship contribution statement

Scott Squires contributed to study design, data collection and analysis, as well as manuscript writing and editing; Mianzhi Hu contributed to data analysis as well as manuscript writing and editing; Roumen Milev and Jordan Poppenk contributed to study design, direction of analysis, and manuscript editing.

Conflict of interest

None.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jad.2022.05.039.

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