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Brief report

Psychological well-being of ruminative adolescents during the transition to COVID-19 school closures: An EMA study

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ABSTRACT

Introduction: Adolescents with moderate-to-severe levels of trait rumination are at heightened risk for psychopathology and may be particularly vulnerable to disruptions caused by the onset of the COVID-19 pandemic. As most past research documenting the impact of COVID-19 on adolescent well-being has been cross-sectional, it is unclear exactly how ruminative adolescents responded to the onset of the pandemic as it unfolded.

Methods: We used ecological momentary assessment (EMA) to explore changes in rumination among adolescents during the initial transition to distance learning in the United States. A subsample of 22 ruminative youth ($M_{age} = 13.58$; $SD = 0.96$; 54.5% male; 86.4% White) from a larger study provided EMA data throughout January–April 2020 (M responses per participant = 105.09, $SD = 65.59$). Following school closures, we hypothesized that adolescents would report greater rumination (i.e., focusing on emotions and problems) and depressive symptom level would moderate this effect.

Results: Surprisingly, rumination decreased, and this effect was moderated by depressive symptom level for emotion-focused rumination, i.e., those with average and below-average depressive symptoms experienced decreases in rumination.

Conclusions: These results suggest that the first wave of stay-at-home orders and the transition to distance learning were not immediately distressing to vulnerable adolescents. However, more research is needed to determine whether the results from recent research are generalizable to other adolescents and to examine the long-term impact of the pandemic on adolescent well-being.

Shortly after the COVID-19 outbreak was declared a global pandemic by the World Health Organization on March 11th, 2020 (WHO, 2020), schools transitioned to distance learning, and stay-at-home orders were enacted in the United States and globally. Several studies documented decreased well-being among adolescents in response to the pandemic (e.g., Orgilés et al., 2020; Zhou et al., 2020). Due to the cross-sectional and between-person nature of these studies, however, it is unclear how adolescents responded to this transition as it unfolded – particularly ruminative adolescents, who are vulnerable to the onset of depression following stressors (e.g., Michl et al., 2013) and natural disaster (Felton et al., 2013).

Ecological momentary assessment (EMA) allows for the examination of both between-individual differences and within-individual changes to further understand the relation between variables (e.g., rumination and depressive symptoms) as a function of time. We used intensive EMA methods to determine sources of variation (i.e., captured intra-individual differences in rumination by observing

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the same individuals across different times) and examined changes in daily rumination prior to and following the local school closures (i.e., the first identifiable and uniform pandemic-related restriction) in a subsample of ruminative adolescents. This afforded us a window into their emotional lives as they responded to the pandemic's onset in real time. We hypothesized that adolescents would report greater rumination following school closures and that baseline depressive symptoms would moderate this effect (i.e., those with greater levels of depressive symptoms would report greater increases in rumination).

1. Method

1.1. Participants

Participants were 22 Midwestern American adolescents aged 12–15 (M age = 13.58, SD = 0.96; 54.5% male; 86.4% white) from a larger study. Eligibility criteria included ruminating at least “sometimes” based on two questions (CRSQ; Abela et al., 2002). Participants in the present study were enrolled starting at January 1, 2020 and completed ≥ 5 EMA entries before and after March 16, 2020 (date of school closures).

1.2. Procedure

Advertisements for a study investigating a mobile app were mailed to the parents of students at public schools. Participants provided informed consent and assent, completed baseline questionnaires, and were randomly assigned to an experimental (i.e., mindfulness and EMA) or control (i.e., EMA only) condition. Immediately following enrollment, notifications prompted participants to use the app three times a day for three weeks, after which participants were welcome, but no longer prompted, to continue using it. Those in the experimental condition occasionally received brief mindfulness exercises. For additional details, please see registration at clinicaltrials.gov (NCT 03900416). On average, participants used the app 2.35 (SD = 0.65) times per day between January and April. Before and after school closures, participants used the app 17.69 (SD = 3.68) and 16.17 (SD = 8.05) times per week, respectively.

1.3. Measures

1.3.1. Depressive symptoms

Baseline depressive symptoms were assessed using the Children's Depression Inventory (CDI; Kovacs, 1985), a reliable and valid 27-item measure to assess symptoms during the last two weeks (Craighead et al., 1995; Klein et al., 2005). The CDI demonstrated good reliability in this sample (α = 0.87).

1.4. State rumination

Adolescents answered two separate questions assessing state rumination each time they used the app. These questions asked how much participants were currently “focusing on their emotions” and “problems” from 0 (*not at all*) to 100 (*extremely*), adapted from Moberly and Watkins (2008). Past research has used these two questions to assess subtypes of state rumination separately among adolescents (2021Webb et al.,).

1.5. Data analytic plan

We examined descriptive statistics and zero-order correlations. A dummy variable categorized whether a diary entry was completed prior to or following the onset of local school closures. Participants with ≥ 5 entries before and after school closures were included (n = 23), so that each participant met the minimal number of data points necessary to model growth. One outlier was removed due to extremely high app use.

Leveraging EMA data pre- and -post school closures to detect change in state rumination across this transitional period, and accounting for the nested nature of the data (moments nested in adolescents), we fit two-level models and growth models in MPlus Version 7.4 (Muthén & Muthén, 1998–2012) using maximum likelihood estimation with robust standard errors. We used multilevel models to predict state rumination from pre/post school closures, CDI symptoms, and their interaction. We also conducted sensitivity analyses (i.e., linear and bilinear spline analyses; Grimm et al., 2017) to examine (a) overall growth in state rumination during the entire study period and (b) within two segmented periods (pre-school closure growth and post-school closure growth) to determine whether growth was continuous (linear increase or decrease across the study period) or being driven by one of the two study periods (i.e. whether growth changed at the school closure transition point). These models included condition to determine whether being in the experimental or control group predicted the growth parameters. Continuous Level 1 predictors were centered within-person and Level 2 predictors were grand-mean centered (Enders & Tofghi, 2007).

2. Results

2.1. Descriptives and correlations

Participants used the app 1444 times before school closures (M = 66 app uses total per participant, range = 10–195) and 868 times

after school closures ($M = 39$ app uses total per participant, range = 10–92).

Independent t-tests revealed no significant differences in age ($t = 0.19$ [95% CI: $-0.83, 0.99$]; $p = .85$), sex ($t = -0.24$ [95% CI: $-0.53, 0.42$]; $p = .81$), race ($t = -0.44$ [95% CI: $-0.39, 0.25$]; $p = .67$), CDI depressive symptoms ($t = 1.35$ [95% CI: $-2.29, 10.66$]; $p = .19$), emotion-focused rumination ($t = -0.03$ [95% CI: $-18.05, 17.58$]; $p = .98$), or problem-focused rumination ($t = 1.29$ [95% CI: $-6.30, 26.84$]; $p = .21$) between control ($n = 12$) and experimental ($n = 10$) groups. Emotion-focused ($M = 35.04, SD = 29.67$) and problem-focused rumination ($M = 34.30, SD = 29.76$) items were positively correlated ($r = 0.43, p < .01$) at the within-person level. In line with past research (Webb et al., 2021), items were kept separate to assess distinct subtypes of rumination. Rumination variables were averaged across each participant, and person-level variables were not significantly correlated ($r = 0.38, p = .08$). CDI score ($M = 13.18, SD = 7.39$) was not correlated with either of the person-level rumination outcomes (all $ps > .32$).

Person-level correlations and t-tests with potential covariates (age, income, sex, and race) and state rumination variables were not significant and thus age, income, and sex were not included in multivariate analyses. Race was included as a covariate for problem-focused outcome analyses ($t = 2.70$ [95% CI: $2.99, 24.83$]; $p = .02$). Time of day of diary completion ($M = 3:20$ p.m., $SD = 53.4$ min), total number of diaries ($M = 105.09, SD = 65.59$), and condition were conceptually included as covariates.

2.2. Pre/post school closure state rumination

The difference in state rumination levels from pre-to-post-school closure were examined (Table 1). The pre/post dummy significantly predicted whether participants focused on their emotions (i.e., lower emotion-focused rumination post school closure), but it did not predict focusing on problems.

2.3. Pre/post school closure moderated by depressive symptoms

Table 1 shows the results from analyses examining whether depressive symptoms moderated associations between time (i.e., pre or post-school closure) and state rumination. A significant main effect of pre-to-post-school closure on both rumination outcomes emerged, with participants focusing less on problems and emotions post-school closures. Depressive symptoms significantly moderated the association between time and focusing on emotions. Simple slopes analyses demonstrated lower levels of focusing on emotions after school closures compared to before school closures for participants who reported low (-1 SD from mean; $\beta = -10.82, p < .01$) and average ($\beta = -5.99, p < .01$), but not high depressive symptoms ($+1$ SD from mean; $\beta = -1.16, p = .67$; Fig. 1). Regions of significance suggested the association of focusing less on emotions after school closures was significant at values of depressive symptoms less than 16, 77.3% of the sample.

2.4. Sensitivity analyses

Post-hoc growth analyses determined whether the pre-to-post school closure emotion differences were due to growth over the study

Table 1
Fixed effects estimates from multilevel models predicting state rumination from pre/post school closure, CDI total symptoms, and their interaction.

Fixed effects	Focusing on Emotions			Focusing on Problems		
	Est.	SE	95% CI	Est.	SE	95% CI
Main Effects						
Intercept (γ_{00})	43.77**	7.59	28.90, 58.64	48.48**	11.51	25.92, 71.05
CDI Total Symptoms (γ_{01})	0.17	0.47	-0.78, 1.12	0.83	0.45	-0.04, 1.71
Condition (γ_{02})	1.83	8.66	-15.14, 18.80	-6.44	7.03	-20.21, 7.34
Number of Diaries (γ_{03})	-0.07	0.07	-0.22, 0.07	-0.03	0.07	-0.16, 0.09
Race (γ_{04})	-	-	-	-17.66*	7.75	-32.85, -4.90
Pre/Post School Closure (γ_{10})	-8.84*	4.12	-16.93, -0.76	14.30	11.81	-8.85, 37.44
Time of Day (γ_{20})	0.18*	0.09	0.00, 0.36	-0.09	0.14	-0.37, 0.19
Moderated Effects						
Intercept (γ_{00})	44.21**	7.25	30.00, 58.41	72.24**	11.78	49.15, 95.33
CDI Total Symptoms (γ_{01})	0.18	0.48	-0.77, 1.12	1.05*	0.46	0.14, 1.96
Condition (γ_{02})	1.91	8.67	-15.08, 18.90	-5.33	7.35	-19.73, 9.07
Number of Diaries (γ_{03})	-0.08	0.07	-0.22, 0.06	-0.07	0.05	-0.18, 0.03
Race (γ_{04})	-	-	-	-27.86**	10.32	-48.08, -7.64
Pre/Post School Closure (γ_{10})	-5.99**	1.89	-9.69, -2.29	-5.79*	2.74	-11.16, -0.43
Pre/Post School Closure X CDI Total Symptoms (γ_{11})	0.67*	0.27	0.14, 1.20	-0.23	0.41	-1.03, 0.57
Time of Day (γ_{20})	0.18*	0.09	0.01, 0.36	-0.09	0.14	-0.37, 0.18

Note. 2312 diary entries nested within 22 individuals. Est. = partial regression coefficient estimate (unstandardized); SE = robust standard error. Focusing on Emotions = how much participants were focusing on their emotions on a scale of 0 (“not at all”) to 100 (“extremely”); Focusing on Problems = how much participants were focusing on their problems on a scale of 0 (“not at all”) to 100 (“extremely”); Pre/Post School Closure: 0 = pre-school closure, 1 = post-school closure; Condition: 0 = EMA only, 1 = EMA + Mindfulness; Number of Diaries = total number of diary entries for each participant; Race: 0 = Non-White, 1 = White. Time of Day = time (24-h clock) of diary. * $p < .05$, ** $p < .01$.

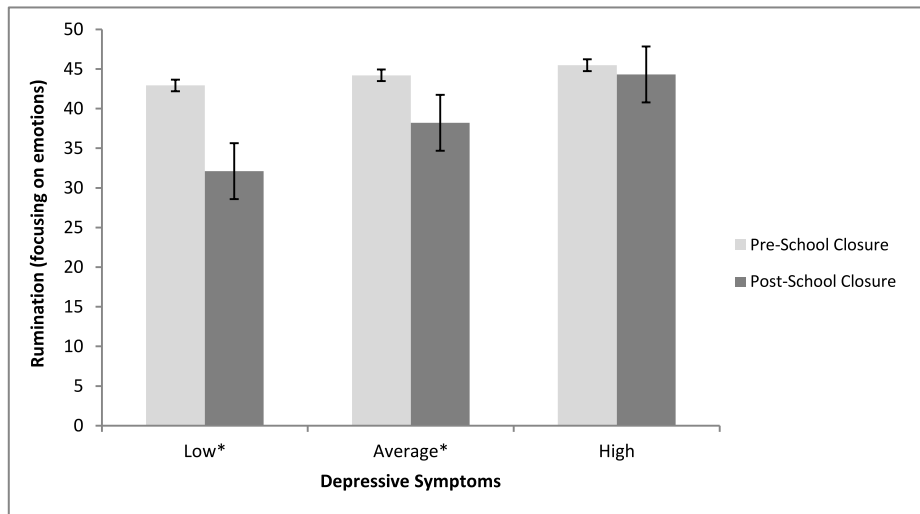


Fig. 1. Pre and Post-School Closure by CDI Total Symptoms (± 1 SD from grand mean) on Emotion-Focused Rumination (on 0–100 scale). Note. State emotion-focused rumination (how much participants were focusing on their emotions on a scale of 0 (“not at all”) to 100 (“extremely”) at low, average, and high levels of CDI total symptoms score at pre-school closure (January 1, 2020 to March 15, 2020) and post-school closure (March 16, 2020–April 16, 2020).

* $p < .01$.

period in level of the state rumination outcomes. Results from spline analyses were non-significant, suggesting that state rumination was not increasing or decreasing over the study period (or before or after school closures). The only significant effect of condition was on post-school closure growth of problem-focused rumination ($\beta = -0.31$, $p = .03$), such that those in the experimental condition demonstrated decreases in rumination after school closures.

3. Discussion

Rumination decreased following school closures. Reductions in emotion-focused rumination were moderated by depressive symptom level in that adolescents with average and below-average, but not above-average, depressive symptoms focused less on their emotions. Condition did not significantly predict total growth over the entire study period of either state rumination outcome; however, it did significantly predict growth for problem-focused rumination following school closure.

Several factors may have influenced these results. Daily stressors are greater during the school year (Verma et al., 2017); transitioning to distance learning possibly reduced daily stressors prompting for rumination. Poor sleep quality contributes to decreased emotion regulation (e.g., Palmer et al., 2018). Possibly, adolescents spent more time sleeping (Origilés et al., 2020). Though the first case of COVID-19 was documented in the United States in January (CDC, 2020) and cases were spreading rapidly in other states in March (e.g., New York), documented cases in this community were much lower; thus, adolescents may not have experienced factors associated with adverse psychological outcomes following disasters (e.g., close proximity to threat, perception of threat, personal loss; Furr et al., 2010). Alternatively, adolescents may have felt relief from the stress of potential exposure to the novel coronavirus.

Our findings complement those of another study (Janssen et al., 2020), reporting no changes in daily negative affect following school closures, suggesting school closures and stay-at-home orders alone may not have been immediately distressing to vulnerable adolescents. However, as discussed by Janssen et al., heterogeneity should be considered as a contributing factor.

A strength of the study was the impressive number of daily diary reports recorded ($N = 2312$). However, we were not able to determine what prompted rumination, the sample size was small ($n = 22$), and participants were predominantly white, limiting generalizability.

These results provide important insight into the early stages of the pandemic as it unfolded in real-time for adolescents. Future research is needed, however, to identify the long-term impact of the pandemic on adolescent well-being. Finally, our results demonstrated that adolescents with high levels of depressive symptoms did not show improvements in rumination, a finding that aligns with research documenting that depressive symptoms fuel rumination (Moberly & Watkins, 2008), but also further emphasizes the need for accessible and cost-effective interventions (e.g., app-delivered interventions) for adolescents experiencing depressive symptoms at high levels.

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Declaration of competing interest

We have no conflicts of interest to disclose.

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