

Title: Exploring the role of psychological resilience in changes in depressive and anxious symptoms during the COVID-19 quarantine among Peruvian adolescents

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Aims:

1. To investigate whether the change in depressive and anxious symptoms at the individual level is moderated by an individual's psychological resilience.
2. To investigate whether the moderating role of psychological resilience is stronger among females than males.
3. To investigate the impact of grade-level on the moderating role of psychological resilience in depressive and anxious symptoms.
4. To investigate the role of the CYRM-R resilience subscales (intra/interpersonal vs. caregiver) in predicting change in depressive and anxious symptoms and the association of this relationship with grade.

Hypotheses:

1. Confirmatory hypotheses:
 - a. Change in depressive symptoms at the individual level will be moderated by resilience level (as assessed by the CYRM-R), with lower CYRM-R scores correlating with a greater increase in depressive symptoms.
 - b. Change in anxious symptoms at the individual level will be moderated by resilience level (as assessed by the CYRM-R), with lower CYRM-R scores correlating with a greater increase in anxious symptoms.
2. Confirmatory hypotheses:
 - a. We expect that the moderating role of resilience is stronger among females than males for depressive symptoms.
 - b. We expect that the moderating role of resilience is stronger among females than males for anxious symptoms.
3. Exploratory hypotheses:
 - a. We will explore whether the moderating role of resilience differs by grade level for depressive symptoms.
 - b. We will explore whether the moderating role of resilience differs by grade level for anxious symptoms.
4. Exploratory hypotheses:
 - a. We will explore whether the moderating role of resilience differs significantly between intra/interpersonal resilience and caregiver resilience (especially by grade) for depressive symptoms.
 - b. We will explore whether the moderating role of resilience differs significantly between intra/interpersonal resilience and caregiver resilience (especially by grade) for anxious symptoms.

Note: Hypotheses and aims 3a and 3b and 4a and 4b have been made exploratory due to lack of clarity on a directional trend of this relationship in the literature.

Larger study and existing data:

Data were collected as part of a larger, six week project conducted among 6th to 11th grade students in Innova schools in Peru during the COVID-19 quarantine called Transitions: Fostering Digital Citizenship in Adolescence. This study, which began on April 20th, 2020 (the sixth week of lockdown) and ended on May 29th, 2020 (the 11th week of lockdown) included the dissemination of a Wellbeing During Lockdown curriculum. Self-guided sessions including short-videos, reflection questions, and activities were delivered weekly and participants filled out questionnaires measuring social media use, social connectedness, mental health and wellbeing.

At the time of uploading this preregistration, authors V.G.W., M.B., J.H.P, and R.D. have not yet accessed the data from this study and thus these hypotheses and analyses have not been influenced by existing findings. It is important to note that authors L.M.W. and E.B. are aware of a few initial findings of the study including the number of participants matched in weeks one and six, attrition rates, and a general increase in mental health problems in the sample during quarantine--however these findings are not related to the present analyses which focus on psychological resilience levels. Data on resilience has not been accessed by any of the authors.

Methods:

Depression was assessed via the Patient Health Questionnaire-2 (PHQ-2; Kroenke et al., 2003) twice (during weeks one and six). This two-item questionnaire asks participants to respond to items asking how often, over the last two weeks, participants have had "little interest or pleasure in doing things" and been "feeling down, depressed or hopeless." Responses to each item are recorded on a 4-point Likert scale, ranging from "not at all" to "nearly every day". Item responses are summed to produce a raw score, ranging from 0 to 6, with a score of 3 indicating that a diagnosis of major depressive disorder is likely.

Anxiety was assessed via the 4-item Patient-Reported Outcomes Measurement Information System Pediatric Item Bank v2.0 (PROMIS;Quinn et al., 2014) twice (during weeks one and six). The PROMIS is a 4-item self-report scale in which subjects report on their anxious moods and behaviors over the past 7 days on a 5-point scale (1 for *never* to 5 for *always*).

During week five, resilience was assessed via the 17-item Rasch-validated Revised Child and Youth Resilience Measure (CYRM-R) consisting of two subscales (intra/interpersonal resilience and caregiver resilience) (Jefferies, McGarrigle, & Ungar, 2019). Caregiver resilience "relates to characteristics associated with the important relationships shared with either a primary caregiver" whereas intra/interpersonal resilience refers to personal resilience captured via intrapersonal and interpersonal items. The CYRM-R is an appropriate measure across multiple contexts and cultures and contains items obtained from the International Resilience Project (Ungar & Theron, 2015) which includes data from 11 countries across five continents (Jefferies, McGarrigle, & Ungar, 2019).

Prior to data processing, 1,398 participants completed the questionnaires at weeks one, five, and six which includes both times points of the PROMIS and PHQ-2 (week one and week six) and the CYRM-R (week five). We expect some of these individuals to be removed during data cleaning. 1,812 individuals filled out anxiety and depression at time point one (during week one) along with the CYRM-R and we plan to include those in our analysis who pass our data cleaning process outlined below.

Data Processing

Individuals who selected the same answer for every CYRM-R item will be excluded. Individuals who answered at least 7 of the 10 items on CYRM-R intra/interpersonal resilience subscale and who answered 5 out of 7 items on the CYRM-R caregiver resilience subscale will be included in the analysis. If participants only answered 7, 8, or 9 of the 10 CYRM-R items in the intra/interpersonal resilience subscale or 5 or 6 items of the 7 in the caregiver resilience subscale, their scores will be imputed by calculating an average CYRM-R score based on the questions that they did answer. If participants answered fewer than 7 of the 10 CYRM-R items on the intra/interpersonal resilience subscale, or fewer than 5 items on the caregiver resilience subscale, those participants will be excluded. If the distribution of CYRM-R scores is skewed, data will be transformed appropriately to obtain an approximate normal distribution. Outliers on the CYRM-R after transformation ($-3 > z > 3$) will be winsorized to 1% above the next highest or below the next lowest value.

Individuals who did not complete both items on the PHQ-2 will be excluded from analyses of the time point where their data were missing. Our mixed effects model allows us to retain participants with complete PHQ-2 responses for just time point one (even if they did not fill out anxious and depressive symptoms at both weeks one *and* six). We will check the assumptions of mixed effects models and adjust for non-normality as necessary.

Individuals who did not complete all four items on the PROMIS will be excluded from analysis of the time point where their data were missing. Our mixed effects model allows us to retain participants with complete PROMIS responses for just time point one (even if they did not fill out anxious and depressive symptoms at both weeks one *and* six). We will check the assumptions of the LMM and adjust for non-normality as necessary.

Data analyses

All data analyses will be conducted in R 3.6.1 (R Core Team, 2019) using *apaTables* to calculate mean and standard deviations and bivariate correlations between variables (Stanley, 2018) and *compareGroups* for group comparisons (Subirana, 2014).

Two series of mixed-effects models will be conducted in parallel, following the same steps, one with depression symptoms as the outcome variable and the other with anxiety symptoms as the outcome variable. Mixed effects models will be conducted in the lme4 package in R 3.6.1. (R Core Team, 2019; Bates et al., 2015). Significant interactions will be followed up with simple

slopes analyses. Full information maximum likelihood (fiml) will be used to handle missing data. Chi-square likelihood ratio test will be used to compare model fit with a significance threshold/alpha level of 0.05. Effect sizes will be reported.

The mixed effects model equations to be used in model comparisons are outlined below.

Depressive symptoms:

Baseline model: **depression ~ CYRM-R + timepoint + gender + (1|ID)**

Hypothesis 1: **depression ~ CYRM-R*timepoint + gender + (1|ID)**

Hypothesis 2: **depression ~ CYRM-R*timepoint*gender + (1|ID)**

Hypothesis 3: **depression ~ CYRM-R*timepoint*grade + gender + (1|ID)** will be compared to **depression ~ CYRM-R*timepoint + grade + gender + (1|ID)**

Hypothesis 4 - Intra/interpersonal resilience subscale:

depression ~ CYRM-R_personal + timepoint + gender + grade + (1|ID)

depression ~ CYRM-R_personal*timepoint + gender + grade + (1|ID)

depression ~ CYRM-R_personal*timepoint*grade + gender + (1|ID)

Hypothesis 4 - Caregiver resilience subscale:

depression ~ CYRM-R_caregiver + timepoint + gender + grade + (1|ID)

depression ~ CYRM-R_caregiver*timepoint + gender + grade + (1|ID)

depression ~ CYRM-R_caregiver*timepoint*grade + gender + (1|ID)

Anxiety symptoms:

Baseline model: **anxiety ~ CYRM-R + timepoint + gender + (1|ID)**

Hypothesis 1: **anxiety ~ CYRM-R*timepoint + gender + (1|ID)**

Hypothesis 2: **anxiety ~ CYRM-R*timepoint*gender + (1|ID)**

Hypothesis 3: **anxiety ~ CYRM-R*timepoint*grade + gender + (1|ID)** will be compared to **anxiety ~ CYRM-R*timepoint + grade + gender + (1|ID)**

Hypothesis 4 - Intra/interpersonal resilience subscale:

anxiety ~ CYRM-R_personal + timepoint + gender + grade + (1|ID)

anxiety ~ CYRM-R_personal*timepoint + gender + grade + (1|ID)

anxiety ~ CYRM-R_personal*timepoint*grade + gender + (1|ID)

Hypothesis 4 - Caregiver resilience subscale:

anxiety ~ CYRM-R_caregiver + timepoint + gender + grade + (1|ID)

anxiety ~ CYRM-R_caregiver*timepoint + gender + grade + (1|ID)

anxiety ~ CYRM-R_caregiver*timepoint*grade + gender + (1|ID)

Contingency Plans:

In the event that there is limited variability in the CYRM-R (e.g., if everyone reports near ceiling scores), we will conduct data reduction by creating groups with above- versus below-median CYRM-R scores.

If gender is not a significant covariate in the baseline model and does not interact with CYRM*timepoint, it will be dropped from future models.

If the model does not converge, we will calculate change scores in anxious and depressive symptoms and conduct linear regressions instead of mixed-effects models, removing the individual participant intercept and time point. This would only include participants who completed both time points of anxious and depressive symptoms.

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