## Online Supplement

**Nationwide Randomized Trial of Single-Session Interventions for Adolescent Depression amid COVID-19**

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**NOTE**: Code and anonymized data for all study analyses reported in the primary manuscript are available on the Open Science Framework: https://osf.io/8mk6x/

**Contents:**

**PART I: Linear Regression Tables, Primary and Secondary Outcomes**

**Supplementary Table 1 (p. 2)**: Linear regression predicting intervention effects on depressive symptoms at 3-month follow-up *(primary outcome; pre-registered/confirmatory test)*

**Supplementary Table 2 (p. 3):** Linear regression predicting intervention effects on COVID-related trauma symptoms at 3-month follow-up*(secondary outcome; pre-registered/confirmatory test)*

**Supplementary Table 3 (p. 4):** Linear regression predicting intervention effects on generalized anxiety symptoms at 3-month follow-up*(secondary outcome; pre-registered/confirmatory tests)*

**Supplementary Table 4 (p. 5):** Linear regression predicting intervention effects on perceived agency at post-intervention*(secondary outcome; pre-registered/confirmatory test)*

**Supplementary Table 5 (p. 6):** Linear regression predicting intervention effects on perceived agency at 3-month follow-up*(secondary outcome; non-pre-registered/exploratory test)*

**Supplementary Table 6 (p. 7):** Linear regression predicting intervention effects on hopelessness at post-intervention *(secondary outcome; pre-registered/confirmatory test)*

**Supplementary Table 7 (p. 8):** Linear regression predicting intervention effects on hopelessness at 3-month follow-up*(secondary outcome; non-pre-registered/exploratory test)*

**Supplementary Table 8 (p. 9):** Linear regression predicting intervention effects on past-month restrictive eating at 3-month follow-up *(secondary outcome; non-pre-registered/exploratory test)*

**Descriptions of additional secondary outcomes not included in main text (pp. 10-11)**

**Supplementary Table 9 (p. 12):** Regression predicting intervention effects on frequency of suicidal ideation at 3-month follow-up *(secondary outcome; non-pre-registered/exploratory test)*

**Supplementary Table 10 (p. 13):** Linear regression predicting intervention effects on approach-based (versus disengagement-based) coping at 3-month follow-up *(secondary outcome; non-pre-registered/exploratory test*)

**Supplementary Table 11 (p.** **14):** Linear regression predicting intervention effects on implicit theory of personality at post-intervention *(secondary outcome; non-pre-registered/exploratory test*)

**PART II: Study Recruitment Materials and Illustrations**

**Supplementary Figure 1 (p. 15):** Online Instagram advertisement used for study recruitment

**Supplementary Figure 2** **(p. 16)**: Map illustrating geographic distribution of all study participants.

**PART III**: **Supplementary Table 12 (p. 17):** List of all primary, secondary, and other (baseline-only) outcomes.

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| **Supplementary Table 1.** Linear regression predicting Intervention Effects on depressive symptoms (CDI-SF), 3-Month Follow Up | | | | | |
| Predictor | Estimate | Standard Error | t | p value |
| Intercept | 0.28 | 0.03 | 8.09 | < .001 |
| Baseline Value of Outcome Variable | 0.64 | 0.03 | 24.23 | < .001 |
| Placebo (vs. Project ABC) | -0.08 | 0.02 | -3.62 | < .001 |
| Placebo (vs. Project Personality) | -0.08 | 0.02 | -3.53 | < .001 |
| Project ABC (vs. Project Personality) | 0.00 | 0.02 | -0.20 | 0.85 |

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| **Supplementary Table 2.** Linear regression predicting intervention effects on COVID-related trauma symptoms (CTS), 3-Month Follow Up Outcome | | | | | |
| Predictor | Estimate | Standard Error | t | p value |
| Intercept | 1.41 | 0.07 | 21.59 | < .001 |
| Baseline Value of Outcome Variable | 0.51 | 0.02 | 23.29 | < .001 |
| Placebo (vs. Project ABC) | -0.07 | 0.03 | -1.94 | 0.05 |
| Placebo (vs. Project Personality) | -0.08 | 0.04 | -2.08 | 0.04 |
| Project ABC (vs. Project Personality) | 0.01 | 0.04 | 0.28 | 0.78 |

\_family\_did\_not\_enough\_enough\_money\_for\_food \_family\_did\_not\_have\_a\_regular\_place\_to\_sleep\_or\_stay \_i\_could\_not\_attend\_school\_in\_person \_i\_could\_not\_attend\_school\_at\_all \_other \_family\_did\_not\_have\_enough\_money\_for\_gas\_transportation \_family\_did\_not\_have\_enough\_money\_to\_pay\_rent \_the\_covid\_19\_pandemic\_has\_not\_affected\_me\_or\_my\_family\_in\_these\_ways\_in\_the\_past\_2\_weeks b\_covid\_cope\_1\_connecting\_with\_others b\_covid\_cope\_1\_including\_talking\_with\_people\_you\_trust\_about\_your\_concerns\_and\_how\_you\_are\_feeling b\_covid\_cope\_1\_contacting\_a\_healthcare\_provider b\_covid\_cope\_1\_drinking\_alcohol b\_covid\_cope\_1\_smoking\_more\_cigarettes\_or\_vaping\_more

One-hot:

 **Latent Class Analysis (LCA)**: Ideal for identifying distinct subgroups within your data, such as different race/ethnicity profiles or coping strategies.

 **Network Analysis**: Consider network analysis techniques to explore relationships among multiple choices, especially for your challenge and coping strategy variables.

Baseline risk is a summary score inherently related to treatment effect that can be used to represent the variability in patient characteristics[3](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10060247/#CR3),[5](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10060247/#CR5)–[8](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10060247/#CR8). For example, an invasive coronary procedure—compared to medical treatment—improves survival in patients with myocardial infarction at high (predicted) baseline risk but not in those at low baseline risk[9](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10060247/#CR9). It has also been shown that high-risk patients with pre-diabetes benefit substantially more from a lifestyle modification program than low-risk patients[10](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10060247/#CR10).

The recently proposed Predictive Approaches to Treatment effect Heterogeneity (PATH) statement provides systematic guidance on the application of risk-based methods for the assessment of HTE in randomized controlled trial (RCT) data[11](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10060247/#CR11),[12](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10060247/#CR12). After risk-stratifying patients using an existing or an internally derived prediction model, risk stratum-specific estimates of relative and absolute treatment effect are evaluated.

A risk-modeling approach is typically done in 2 steps. First, a multivariable regression model that predicts risk for an outcome (usually the primary study outcome) is identified from external sources (an “external model”) or developed directly on the trial population without a term for treatment assign- ment (an “internal model”) (equation 1 in Table 2).

Since multiple choice, there is underlying mixtures of distributions

Conculsion

Although internally derived (or endogenous) prognostic models can provide reliable estimates of treatment effects within trial risk strata,[98](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6889830/#ref98) the implementation of an externally valid prognostic model is necessary for translation into practice. The finding of clinically important HTE across risk strata within a trial provides an important impetus for implementing an externally valid model. It should be noted that external validity is a general concern for RCT results and is not confined to results subgrouped using risk models.

图示

低可信度描述已自动生成

The underlying assumption is that the overall study population is comprised of a mixture of J subpo;u;lations or classes

To streamline the analysis of sexual orientation data, we have merged the original categories into broader groups. The following steps were taken:

1. **Other**: This category includes individuals who identify as Asexual, those who do not use a specific label for their sexual orientation, and those who selected "Other/Not listed (please specify)".
2. **LGBTQ+**: This category encompasses individuals who identify as Gay/Lesbian/Homosexual, Queer, and those who are Unsure/Questioning about their sexual orientation. This grouping represents a broader spectrum of non-heterosexual identities.
3. **Bisexual/Pansexual**: This combined category includes individuals who identify as Bisexual and Pansexual. Both orientations reflect an attraction to multiple genders, thus justifying their merger for analytical purposes.
4. **Heterosexual**: This category remains unchanged and includes individuals who identify as Heterosexual/Straight.

By consolidating these categories, we aim to simplify the dataset and ensure that the analysis can focus on broader, yet meaningful, distinctions within the sexual orientation spectrum.

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| **Supplementary Table 3.** Linear regression predicting Intervention Effects on anxiety symptoms (GAD-7), 3-Month Follow Up | | | | | |
| Predictor | Estimate | Standard Error | t | p value |
| Intercept | 0.90 | 0.07 | 12.25 | < .001 |
| Baseline Value of Outcome Variable | 0.62 | 0.02 | 28.06 | < .001 |
| Placebo (vs. Project ABC) | -0.02 | 0.04 | -0.37 | 0.71 |
| Placebo (vs. Project Personality) | -0.09 | 0.05 | -2.07 | 0.04 |
| Project ABC (vs. Project Personality) | 0.08 | 0.04 | 2.01 | 0.04 |

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| **Supplementary Table 4.** Linear regression predicting Intervention Effects on perceived agency (SHS-Agency Subscale, Post-Intervention | | | | | |
| Predictor | Estimate | Standard Error | t | p value |
| Intercept | 2.78 | 0.09 | 32.22 | < .001 |
| Baseline Value of Outcome Variable | 0.64 | 0.02 | 34.64 | < .001 |
| Placebo (vs. Project ABC) | 0.39 | 0.06 | 6.20 | < .001 |
| Placebo (vs. Project Personality) | 0.19 | 0.06 | 2.99 | < .01 |
| Project ABC (vs. Project Personality) | 0.20 | 0.06 | 3.22 | < .01 |

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| **Supplementary Table 5.** Linear regression predicting intervention effects on perceived agency (SHS-Agency Subscale), 3-Month Follow Up | | | | | |
| Predictor | Estimate | Standard Error | t | p value |
| Intercept | 2.86 | 0.13 | 22.39 | < .001 |
| Placebo (vs. Project ABC) | 0.14 | 0.09 | 1.57 | 0.12 |
| Placebo (vs. Project Personality) | 0.24 | 0.10 | 2.46 | 0.01 |
| Baseline Value of Outcome Variable | 0.52 | 0.03 | 19.04 | < .001 |
| Project ABC (vs. Project Personality) | -0.10 | 0.09 | -1.04 | 0.3 |

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| **Supplementary Table 6.** Linear regression predicting intervention effects on hopelessness (BHS-4), Post-Intervention | | | | | |
| Predictor | Estimate | Standard Error | t | p value |
| Intercept | 0.19 | 0.03 | 5.77 | < .001 |
| Baseline Value of Outcome Variable | 0.69 | 0.02 | 45.36 | < .001 |
| Placebo (vs. Project ABC) | -0.14 | 0.03 | -5.22 | < .001 |
| Placebo (vs. Project Personality) | -0.16 | 0.03 | -5.80 | < .001 |
| Project ABC (vs. Project Personality) | 0.02 | 0.03 | 0.68 | 0.50 |

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| **Supplementary Table 7.** Linear regression predicting intervention effects on hopelessness (BHS-4), 3 Month Follow Up | | | | | |
| Predictor | Estimate | Standard Error | t | p value |
| Intercept | 0.51 | 0.05 | 10.63 | < .001 |
| Placebo (vs. Project ABC) | -0.15 | 0.04 | -3.49 | < .001 |
| Placebo (vs. Project Personality) | -0.13 | 0.04 | -3.00 | < .01 |
| Baseline Value of Outcome Variable | 0.58 | 0.02 | 26.61 | < .001 |
| Project ABC (vs. Project Personality) | -0.02 | 0.04 | -0.55 | 0.58 |

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| **Supplementary Table 8.** Linear regression predicting intervention effects on past-month restrictive eating (DRS-2), 3 Month Follow Up | | | | | |
| Predictor | Estimate | Standard Error | t | p value |
| Intercept | 0.22 | 0.02 | 11.48 | < .001 |
| Placebo (vs. Project ABC) | -0.08 | 0.02 | -3.64 | < .001 |
| Placebo (vs. Project Personality) | -0.05 | 0.02 | -2.46 | 0.01 |
| Baseline Value of Outcome Variable | 0.63 | 0.02 | 29.54 | < .001 |
| Project ABC (vs. Project Personality) | -0.03 | 0.02 | -1.43 | 0.15 |

**Descriptions of exploratory secondary outcomes not included in main text.**

Implicit personality theory questionnaire (ITPQ).**1** The Implicit Personality Theory Questionnaire assesses youths’ beliefs about the malleability of personality (‘growth mindset’). Using a 1–6 scale, participants rate their agreement with three statements addressing the malleability of personality (e.g. ‘Your personality is something about you that you cannot change very much’). Higher total mean scores indicate stronger fixed mindsets, and lower scores, stronger growth mindsets. The ITPQ was administered at pre- and immediately post-SSI in this study. Alphas were 0.84 and 0.92 at baseline and post-intervention, respectively. No analyses were pre-registered for this outcome.

Behavioral Activation for Depression Scale - Short Form (BADS-SF).2 Youths’ approach-based (versus disengagement-based) coping was assessed via the BADS-SF, a 9-item self-report questionnaire with strong reliability, predictive validity, and sensitivity to change following BA for adolescent depression symptoms. Respondents rate agreement with each of 9 items on the BADS-SF on a 7- point Likert scale ranging from 0-6, with higher mean scores reflecting more approach-based coping. The BADS-SF was administered at pre-SSI and at 3-month follow-up. Alphas were 0.70 and 0.81 at baseline and follow-up, respectively. No analyses were pre-registered for this outcome.

Self-Injurious Thoughts and Behaviors Interview-Short Form (SITBI-SF).**3** Four items from a self-report version of the SITBI-SF were used to assess lifetime and past-month history of suicide ideation and attempts. The SITBI-SF is a widely used measure of the continuum of suicidality and has demonstrated high test-retest reliability, high internal consistency, and moderate-to-high concurrent validity.2 This measure was administered at pre-SSI and at 3-month follow up. Score range can vary widely (per wide variation in instances of suicidal ideation), with minimum scores of 0 and no maximum scores. Due to display logic within the measure when administered online, the only item on the SITBI-SF for which all study participants provided data was: “Have you ever had thoughts of killing yourself?” where 0 = “no” and 1 = “yes”. All participants had a score for this variable of either 0 or 1 at pre-intervention andat follow-up. Thus, we report intervention effects on presence of lifetime suicidal ideation during the 3-month follow-up period, controlling for pre-intervention lifetime presence of suicidal ideation. In other words, we tested whether the SSIs prevented the onset of suicidal ideation among participants who endorsed never having experienced it at pre-intervention. No analyses were pre-registered for this outcome.

1. Yeager, D. S., Miu, A. S., Powers, J., & Dweck, C. S. (2013). Implicit theories of personality and attributions of hostile intent: A meta‐analysis, an experiment, and a longitudinal intervention. *Child development*, **84**, 1651-1667 (2013).

2. Fuhr, K., Hautzinger, M., Krisch, K., Berking, M., & Ebert, D. D. Validation of the Behavioral Activation for Depression Scale (BADS)—Psychometric properties of the long and short form. *Comprehensive Psychiatry*, **66**, 209-218 (2016).

3. Nock, M. K., Holmberg, E. B., Photos, V. I., & Michel, B. D. Self-Injurious Thoughts and Behaviors Interview: Development, reliability, and validity in an adolescent sample. Psychological Assessment **19**, 309–317 (2007).

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| **Supplementary Table 9.** Regression predicting intervention effects on onset of lifetime suicidal ideation across the 3 Month Follow Up | | | | | |
| Predictor | Estimate | Standard Error | t | p value |
| Intercept | 0.27 | 0.03 | 10.59 | < .001 |
| Placebo (vs. Project ABC) | -0.02 | 0.02 | -0.89 | 0.37 |
| Placebo (vs. Project Personality) | -0.01 | 0.02 | -0.58 | 0.56 |
| Baseline Value of Outcome Variable | 0.60 | 0.02 | 25.66 | < .001 |
| Project ABC (vs. Project Personality) | -0.01 | 0.02 | -0.32 | 0.75 |

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| **Supplementary Table 10.** Regression predicting intervention effects on Behavioral Activation for Depression Scale – Short Form (BADS-SF), 3 Month Follow Up | | | | | |
| Predictor | Estimate | Standard Error | t | p value |
| Intercept | 2.04 | 0.08 | 25.12 | < .001 |
| Placebo (vs. Project ABC) | 0.05 | 0.04 | 1.34 | 0.18 |
| Placebo (vs. Project Personality) | 0.06 | 0.04 | 1.64 | 0.1 |
| Baseline Value of Outcome Variable | 0.35 | 0.03 | 13.82 | < .001 |
| Project ABC (vs. Project Personality) | -0.01 | 0.04 | -0.30 | 0.77 |

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| **Supplementary Table 11.** Linear regression predicting intervention effects on implicit theories of personality (ITPQ), post-intervention | | | | | |
| Predictor | Estimate | Standard Error | t | p value |
| Intercept | 0.61 | 0.07 | 8.90 | < .001 |
| Placebo (vs. Project ABC) | -0.13 | 0.05 | -2.39 | 0.02 |
| Placebo (vs. Project Personality) | -0.81 | 0.06 | -14.23 | < .001 |
| Baseline Value of Outcome Variable | 0.67 | 0.02 | 40.07 | < .001 |
| Project ABC (vs. Project Personality) | 0.68 | 0.05 | 12.86 | < .001 |

PART III: Study Recruitment Materials

**Supplementary Figure 1.** Sample Instagram ads used for study recruitment. All ads utilized identical text and linked directly to the baseline screener (housed within Qualtrics).

A picture containing text

Description automatically generated

**Supplementary Figure 2**. Geographic distribution of study participants (N = 2,452).

Map

Description automatically generated

**Supplementary Table 12.** Full list of primary, secondary, and other (baseline-only) outcomes collected during the study, including when during the trial they were assessed. A full description of each measure, including scoring ranges and administration procedures, is described in full on the clinicaltrials.gov registration: <https://clinicaltrials.gov/ct2/show/NCT04634903>

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| --- | --- | --- | --- |
| **Measure (Primary, Secondary, Other)** | **Baseline** | **Post-Intervention** | **3-month Follow-up** |
| Children’s Depression Inventory - SF (primary) | X |  | X |
| Generalized Anxiety Disorder-7 (secondary) | X |  | X |
| State Hope Scale - Agency Subscale (secondary) | X | X | X |
| Beck Hopelessness Scale - 4 item version (secondary) | X | X | X |
| COVID-19 Trauma Symptoms, Child Trauma Screen Reaction Scale (secondary) | X |  | X |
| Dietary Restriction Screener (secondary) | X |  | X |
| Program Feedback Scale (secondary) |  | X |  |
| Implicit Personality Theory Questionnaire (secondary) | X | X |  |
| Behavioral Activation for Depression Scale – Short Form (secondary) | X |  | X |
| Self-Injurious Thoughts and Behaviors Interview-Short Form (secondary) | X |  | X |
| Self-Referential Encoding Task (SRET) (other) | X |  |  |
| UCLA Loneliness Scale | X |  |  |
| Multidimensional Peer Victimization Scale | X |  |  |
| Adverse Childhood Experiences (ACES) scale (other) | X |  |  |
| Brief Screener for Tobacco, Alcohol, and Other Drugs (other) | X |  |  |
| Everyday Discrimination Scale (other) | X |  |  |
| Macarthur Scales on Perceived Socioeconomic Status (other) | X |  |  |
| COVID-19-relevant stressors, per CDC Item Bank | X |  |  |
| Demographic questions | X |  |  |