Brazilian Journal of Psychiatry
bjp
Revista Brasileira de Psiquiatria
Brazilian Psychiatric Association
Fully open access
No APCs

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(article published as accepted)

Original Article

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http://doi.org/10.47626/1516-4446-2025-4495

Submitted: 12-Aug-2025

Accepted: 20-Jan-2026

This is a preliminary, unedited version of a manuscript that has been accepted for publication in the Brazilian Journal of Psychiatry. As a service to our readers, we are providing this early version of the manuscript. The manuscript will still undergo copyediting, typesetting, and review of the resulting proof before it is published in final form. The final version may present slight differences in relation to the present version.

Mental Health and Well-being of Adolescents and Young Adults from Pre- to COVID-19: the impact of pandemic-related risk factors and the protective role of a cash transfer program

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ABSTRACT

Objective: Few longitudinal studies have evaluated the COVID-19 pandemic's impact on youth mental health, particularly in low- and middle-income countries where financial vulnerability may heighten risk. This study examined changes in

psychopathology and well-being among Brazilian youth during the pandemic and the potential protective role of an emergency cash transfer program.

Methods: Data came from 1,385 Brazilian High-Risk Cohort participants evaluated pre-COVID-19 and during the pandemic. Mental health problems and well-being were assessed with the Strengths and Difficulties Questionnaire (SDQ) and the Short Warwick-Edinburgh Mental Well-Being Scale (SWEMWBS), daily well-being was assessed using Ecological Momentary Assessment (EMA) for a subsample. Changes over time were examined using linear mixed-effects models.

Results: Participants not exposed to COVID-19 infection (Estimate = −1.25, t = −4.637, $p < 0.001$) and those reporting no difficulty adhering to social distancing (Estimate = −1.33, t = −4.401, $p < 0.001$) showed reductions in mental health problems. Youth not receiving emergency cash transfers experienced decreased well-being (Estimate = −0.88, t = −2.766, $p = 0.034$), while beneficiaries reported more positive affect in EMA subsample (Estimate = −0.25, t = −2.991, $p = 0.009$).

Conclusions: Lower exposure to pandemic-related stressors was associated with better mental health. Emergency cash transfers may have mitigated declines in well-being, highlighting their relevance for supporting youth during crises.

Keywords: Youth mental health, COVID-19, cash transfer program, well-being, psychopathology

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Introduction

The COVID-19 pandemic profoundly impacted global health and economic resources – having a particularly negative impact on mental health and well-being around the globe.[1,2] While studies in adult populations have yielded conflicting results regarding changes in depression, anxiety, and other mental health symptoms from pre- to during-COVID-19 pandemic onset,[3,4] meta-analytic evidence supports a consistent increase in such symptoms among children and adolescents.[5,6] However, there is a notable scarcity of longitudinal studies addressing COVID-19 pandemic-related changes in the mental health of

youths from low- and middle-income countries (LaMICs), where interestingly the majority of the world's youth population lives.[6]

The main risk factors associated with an increase in youth mental health problems after the COVID-19 pandemic started were older age,[7] female gender,[7,8] and low socioeconomic status,[9] as well as pandemic-related factors such as heightened local COVID-19 prevalence.[10,11] Actually, it is possible that the COVID-19 pandemic had an even broader impact on the mental well-being of young people, considering that it is more than the simple absence of psychopathology.[12] Young people may have experienced the pandemic in a way that altered their day-to-day sense of happiness and life satisfaction, as well as their psychological functioning and self-realization.[12] To address these types of changes, researchers have increasingly incorporated real-time assessment strategies, such as Ecological Momentary Assessment (EMA), to capture more subtle and ecologically valid variations in mental well-being.[13] In this study, EMA was used as a complementary and exploratory approach, allowing for the assessment of mood and well-being in natural contexts and reducing recall bias. Although longitudinal studies have found that the mental well-being of youth significantly worsened during the COVID-19 pandemic,[7] few have incorporated EMA-based assessments as a secondary outcome to examine pre- to during-COVID-19 changes.[14,15] By capturing short-term fluctuations in emotional states, EMA can complement traditional retrospective questionnaires and provide additional information on daily variations in well-being.[31-33]

A recent meta-analysis assessing the impact of the COVID-19 pandemic on the mental health of youth highlights the scarcity of studies from Latin America.[6] This situation is unfortunate given the impact of the pandemic on mental health and well-being may be particularly harsh in lower- to middle-income countries.[16] Indeed, in response to the economic challenges associated with the COVID-19 pandemic, some countries adopted societal-level strategies, such as cash transfer programs. For example, the “Auxílio Emergencial” Brazilian COVID-19 Emergency cash transfer program was launched on April 7th, 2020, providing financial aid to eligible individuals (approximately US$115).[17] Importantly, meta-analytic data suggest positive effects of cash transfer programs on the mental health of youth.[18] Given the relative paucity of

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studies examining available programs,[18] we felt it necessary to further evaluate this moderating strategy, in the context of a greater evaluation of the mental health of youth during the COVID-19 pandemic.

In this context, using data from an ongoing community-based Brazilian cohort study, we explored the deleterious impact of pandemic-related factors, such as financial losses, and the potential protective effect of a societal-level strategy (i.e., a governmental emergency cash transfer program) on youth mental health and well-being. *First*, we sought to identify relevant sociodemographic and COVID-related factors potentially associated with changes in mental health from pre- to during-COVID-19 onset pandemic. *Second*, we aimed to expand these previous analyses by incorporating a broader concept of mental health by directly assessing the dimension of mental well-being. *Third*, we sought to explore the effects of a COVID-19 national emergency cash transfer program on pre- *vs.* during-COVID-19 levels of psychopathology and well-being. *Fourth*, in an exploratory analysis using a cohort subsample, we used EMA data to compare mental well-being pre *vs*. during-COVID-19 onset and to evaluate the potential moderating effects of an emergency cash transfer program.

Methods

Sample

The Brazilian High-Risk Cohort for Mental Conditions (BHRC) is an ongoing multisite cohort study that began collecting data from children and adolescents since 2009 in two large Brazilian metropolitan areas (São Paulo and Porto Alegre). For a detailed description of enrollment and baseline procedures, please see Salum et al.[19]

At baseline (Wave-0) in 2010, we evaluated 2,511 subjects using an extensive protocol, involving a 2- to 3-hour household evaluation with the biological parents and two 2-hour evaluations of the children at school (by a psychologist and a speech therapist). Follow-up assessments were designed to occur at 3-year intervals. Here, we compare data from Wave-2 (herein Pre-COVID-19 wave) with Wave-3, a during-COVID-19 onset wave (herein COVID-19 wave) collected approximately three years after Wave-2. Collected approximately six years after baseline assessment, the retention rate at the Pre-

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COVID-19 wave was 76.0% (n=1909 families), from whom we collected 1801 parent- or caregiver-reports and 1690 youth self-reports (mean age 18.2 s.d. 2.0, range 13.5 to 23.0),[20] between 2018-04-29 and 2020-01-31.

Data for the COVID-19 wave was collected via telephone interviews or internet self-report questionnaires from 2020-04-03 to 2021-04-26 (histograms with date distributions for interviews are depicted in Supplemental Methods Table S1 and S2). We collected data from 1615 youths (Telephone n=1011, 62.6%; Internet form n=604, 37.4%).

This study was approved by the National Research Ethics Commission and Institutional Review Board (IRB) from all involved universities and informed consent was obtained from parents and participants. This report is in compliance with the STROBE statement (Supplemental Methods).

Measures

Outcomes

The main outcomes of the present analyses are youth participants' self-reported mental health problems as reported using the Strengths and Difficulties Questionnaire (SDQ) and their mental well-being as reported using the Short Warwick-Edinburgh Mental Well-Being Scale (SWEMWBS). Additionally, daily mental well-being was assessed through an EMA protocol with the specific question "How do you feel now?", both in pre-COVID-19 and COVID-19 waves.

Strengths and Difficulties Questionnaire (SDQ) (herein, mental health problems). Participants were administered the Brazilian Portuguese version of the 25-item self-report version of the SDQ,[21] which is a widely used research instrument for the detection of emotional and behavioral problems. Each item must be rated as: Not True (0), Somewhat True (1), or Certainly True (2). Only one option can be checked per item. Here, we used the Total Difficulties score, including 20 items ranging from 0 to 40 points. Higher scores indicate more Mental Health Problems reported by the youth.

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Short Warwick-Edinburgh Mental Well-being Scale (herein, mental well-being). We assessed mental well-being using the Brazilian Portuguese version of the Short Warwick-Edinburgh Mental Well-being Scale (SWEMWBS),[22] a 7-item self-reported instrument. It was specially developed to measure mental well-being in non-clinical samples. The SWEMWBS covers two different aspects of mental well-being: affect, such as the subjective experience of happiness and life satisfaction (hedonia), and psychological functioning (eudaimonia).[12] Each item must be rated on a Likert scale from 1 to 5, from 1 "None of the time" to 5 "All of the time." Scores range between 7-35, and higher scores indicate better levels of mental well-being. Twenty subjects did not complete all SWEMWBS questions and were excluded from analyses involving this outcome (therefore, n=1367 for models with mental well-being as the outcome).

Ecological Momentary Assessment Protocol (herein, daily well-being). The BHRCS EMA app was developed to collect self-reported real-time data on mental health symptoms through up to five smartphone prompts per day. The protocol included several behavioral domains based on previous EMA protocols, and the present analysis focused on an EMA item developed by the cohort team to evaluate mental well-being: "How do you feel now?". Participants rated their current emotional state on a graphical scale ranging from three thumbs down to three thumbs up, corresponding to a 1–7 Likert scale (Figure S4). Detailed information about our outcomes is available in the Supplemental Methods.

Predictors

Socioeconomic and demographic factors

We also examined age at evaluation, socioeconomic status, sex at birth (Gender), ethnicity (White/Non-White), and educational level (Low/Unknown education, high school, and higher education), categorized into three groups. For a detailed description of the variables, see the Supplemental Methods.

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COVID-19 pandemic-related risk and protective factors

We examined key domains of mental distress and resilience during the COVID-19 pandemic using the Brazilian Portuguese CRISIS questionnaire.[10] This global initiative provided a standardized, reliable tool to investigate COVID-19 impact on mental health (available at www.crisissurvey.org).[10] Here, we used a set of dichotomized CRISIS self-reported variables to assess: Exposure to COVID-19 Infection, COVID-19 Pandemic-related Socioeconomic Impact, Any COVID-19-related Positive Changes in participants' lives, and Any Difficulties in Adhering to Social Distancing (Difficulty Distancing). For a detailed description of all items see Supplemental Methods.

Governmental monetary aid programs

Participants were asked whether they received any financial assistance from the government during the COVID-19 pandemic. If participants answered positively, they were asked to provide a detailed description of the specific type of governmental program they were enrolled in. The answers were categorized in *i.* COVID-19 emergency governmental cash-transfer programs or *ii.* other programs. Importantly, any other aid unrelated to the ongoing pandemic was not considered as a positive response to this variable, such as continuous monetary cash transfer programs (e.g., Bolsa Família).

Statistical analysis

In our analyses, we employed linear mixed-effects models (LME) to examine changes in both Mental Health Problems and Mental Well-being across the two time points (pre-COVID-19 and COVID-19 waves). Separate models were employed for each dependent variable (mental health problems and mental well-being), including fixed effects for time, sociodemographic variables, pandemic-related factors, and their interactions with time. To account for repeated measurements, a random intercept for participant ID was included in all models. Models were estimated using restricted maximum likelihood, and p-values for fixed effects were obtained using the *lmerTest* package. All analyses were conducted in RStudio 4.1.3 setting the threshold for statistical significance at <0.05.

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First, we explored the main effect of time, in models that did not include any time-by-predictor interactions. Second, we examined time-by-predictor interactions to understand how these predictors may have influenced changes in outcomes across time. Third, for significant time-by-predictor interactions, post-hoc analyses were performed applying Bonferroni correction to adjust p-values for multiple comparisons. Post-hoc analyses were restricted to within-group longitudinal contrasts (pre- vs. during-COVID-19 waves), focusing on identifying which subgroups showed significant changes over time rather than differences between groups. The level of statistical significance was set at $p<0.05$ after Bonferroni adjustment for post-hoc analyses.

Exploratory analysis – Ecological Momentary Assessment (EMA) and Governmental Monetary Aid Program

We conducted an exploratory analysis using participants' responses to an EMA protocol implemented in both pre-COVID-19 and COVID-19 waves. This exploratory analysis focused on the governmental monetary aid programs predictor and its effect on changes in the EMA “Thumbs up/Thumbs down” item. Statistical analyses were conducted using a LME model adjusted for age and gender, and included the government's monetary aid-by-time interaction, with Bonferroni adjustment for post-hoc analyses.

Sensitivity analysis

Our COVID-19 wave began on April 3rd, 2020, and concluded on April 26th, 2021. However, the majority of questionnaires were ascertained during the first months of the pandemic. Therefore, to account for the fact that assessments were made at different timepoints during the COVID-19 pandemic, we re-ran all LME models including participants who were assessed until September 26th, 2020 (n=1.274, see Supplemental Methods).

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Results

Descriptives

Present analyses focused on individuals who completed all questionnaires both in pre-COVID-19 wave and the COVID-19 wave assessments, resulting in a sample size of n=1385, with a mean age of 18.3 (s.d 1.5 years) and 19.7 years (s.d. 1.5 years) for the pre-COVID-19 and COVID-19 waves, respectively. Mean follow-up time was 17 months (s.d 5.8 months) Sociodemographic differences between those who participated in one, two or all waves are reported in Supplemental Results and Tables S1 to S3. For the COVID-19 wave, 12.2% of participants reported exposure to the COVID-19 virus, 19.9% experienced some difficulty in adhering to social distancing, and 18.1% reported receiving money from the COVID-19 emergency cash transfer program.

Impact of Sociodemographic and COVID-19 Pandemic-related factors on Mental Health Problems

The main effect of time was statistically significant for the mental health problems variable (Estimate = 1.256, t = 6.782, p = <0.001), showing a mean 1-point decrease in SDQ scores from the pre-COVID-19 to COVID-19 wave (Table S4). Across both time points, females presented higher levels of mental health problems than males, based on sex assigned at birth. Statistically significant interactions emerged for the mental health problems model, including time-by-Gender (Estimate = -0.626, t = -2.126, p = 0.033), time-by-Difficulty Distancing (Estimate = -1.632, t = -4.420, p = <0.001), time-by-COVID-19 Financial Impact (Estimate = -0.756, t = -2.472, p = 0.013), and time-by-Exposure to COVID-19 (Estimate = -1.477, t = -3.287, p = 0.001) (Table 2). Time-by-Skin Color and time-by-Cash Transfer Program Participation interactions were significant, but post-hoc analyses showed no between-group differences. A time-by-SES interaction was not significant. Significant group differences during the COVID-19 wave by risk factors are in Supplemental Results. Adjusted post-hoc analyses revealed significant results for COVID-19 exposure and difficulties adhering to social distancing. To facilitate interpretation, post-hoc analyses focused on within-group longitudinal changes (pre- to during-COVID-19), rather than between-group comparisons. This

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approach allowed us to identify which subgroups experienced significant changes over time in the same individuals, rather than comparing mean differences across distinct groups.

As reported in Table 2, those who reported not being exposed to COVID-19 infection showed a decrease in SDQ scores from the pre-COVID-19 to the COVID-19 wave (Mean Difference: -1.257, s.e. 0.271, $P_{Bonferroni} < 0.001$), as depicted in Figure 1A. SDQ scores also decreased over this time frame among those who did not experience difficulties in adhering to social distancing during the pandemic (Mean Difference: -1.334, s.e. 0.303, $P_{Bonferroni} <0.001$) (Figure 1B).

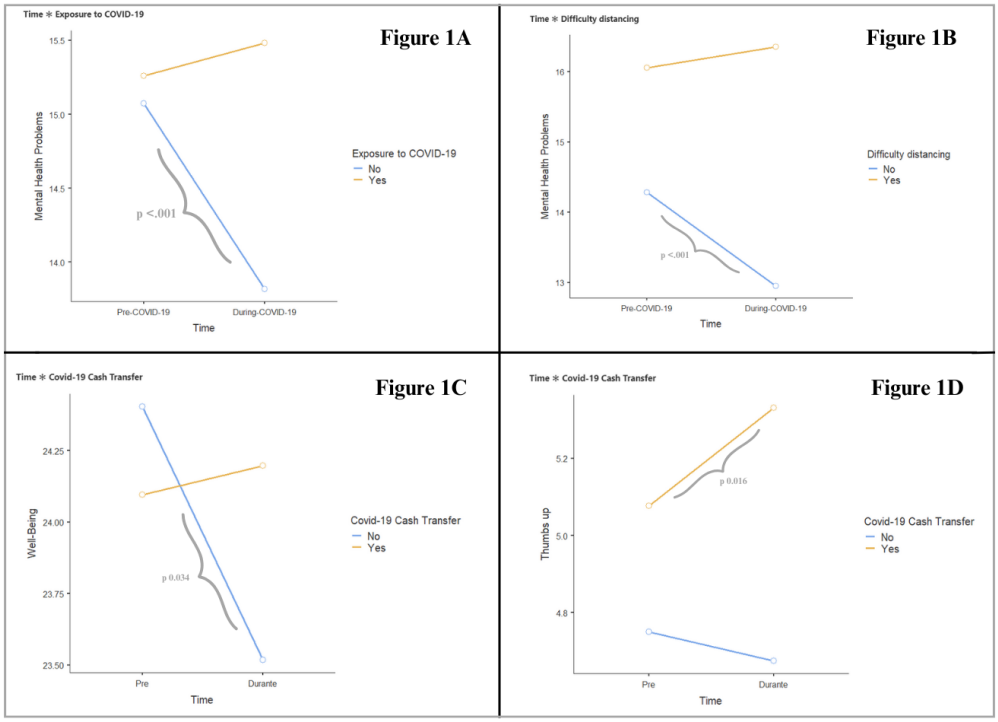


Figure 1 Pos-hoc group focused on longitudinal differences from pre- to COVID-19 waves in pandemic-related predictors on Mental Health Problems and Mental Well-being. Figures illustrate post-hoc group significant differences from Pre-COVID-19 to COVID-19 waves on: (1A and 1B) Mental Health Problems according to the Strengths and Difficulties Questionnaire (SDQ) total problem score (N=1385); (1C) Mental Well-being (Short Warwick-Edinburgh Mental Well-Being Scale, N=1367). Figure 1D presents data from Ecological Momentary Assessment (EMA), including 64 participants from whom n=6,121 EMA assessments were analyzed. Participants responded to EMA assessments asking "How do you feel now?" up to 5 times a day for a 7-day period. This response was graphically rated between three thumbs up and three thumbs down in a 1-7 Likert scale (e.g., three thumbs up = 7 and three thumbs down = 1).

Table 1 Descriptive data: the Brazilian High Risk Cohort COVID-19 wave

Variable	Pre-COVID-19 Wave n=1385	COVID-19 Wave n=1385	Test Statistic
Pre- and COVID-19 Wave			
Mental Health Problems (mean, SD)	**14.47** (6.36)	**13.67** (6.64)	p^1= <.001
Mental well-being (mean, SD)	24.40 (5.60)	24.13 (5.39)	p^1=0.093
Age in years (mean, SD)	18.33 (2.00)	19.76 (1.90)	p^1= <.001
Pre-COVID-19 Wave			
Gender: Female	(48.0%) 665/1385		
Skin color: non-White	(43.9%) 608/1385		
Socioeconomic status (mean, SD)	18.60 (4.54)		
Site: São Paulo	(52.2%) 723/1385		
COVID-19 Wave			
COVID-19 finance impact: Yes		(64.0%) 886/1385	
Exposure to COVID-19: Yes		(11.8%) 164/1385	
Difficulty distancing: Yes		(19.9%) 276/1385	
COVID-19 emergency Cash transfer: Yes		(18.1%) 251/1385	

IQ - 25-75th Interquartile range. [1]Student's t-test for repeated measures.
Time ✻ COVID-19 Cash transfer

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Table 2 Main model for pre-COVID-19 and pandemic-related predictors on mental health problems as measured by the Strength and Difficulties Questionnaire

				95% Confidence Interval				
Names	**Effect**	**Estimate**	**SE**	**Lower**	**Upper**	**df**	**t**	**p**
(Intercept)	(Intercept)	5.432	1.71	2.079	8.781	1666.3518	3.168	**0.001**
Time	COVID-19 - Pre-COVID-19	3.965	0.72	2.556	5.374	1430.540	5.499	**<.001**
Gender	Male - Female	3.695	0.32	3.051	4.339	2017.356	11.202	**<.001**
Skin color	White - Non-white	-0.101	0.33	-0.758	0.554	2017.178	-0.303	0.761
Age at Evaluation	Age at Evaluation	0.322	0.07	0.170	0.475	1576.511	4.136	**<.001**
SES Score	SES Score	-0.011	0.03	-0.082	0.060	2017.250	-0.305	0.760
Site	Porto Alegre City - São Paulo City	0.037	0.34	-0.641	0.716	2008.450	0.108	0.913
Educational Level	Low/Unknown education - High School	-1.619	0.38	-2.372	-0.867	2015.491	-4.203	**<.001**

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Educational Level	Low/Unknown education - Higher Education	-2.787	0.55	-3.874	-1.700	1990.169	-5.007	**<.001**
COVID-19 finance impact	No - Yes	1.316	0.34	0.646	1.986	2015.254	3.838	**<.001**
Exposure to COVID-19	No - Yes	1.664	0.50	0.678	2.650	2013.316	3.295	**0.001**
Difficulty distancing	No - Yes	3.407	0.41	2.600	4.214	2017.236	8.246	**<.001**
Cash Transfer	No - Yes	-0.525	0.42	-1.358	0.306	2009.299	-1.233	0.217
Time ✻ Gender	COVID-19 - Pre-COVID-19 ✻ Male - Female	-0.626	0.29	-1.202	-0.050	1372.867	-2.126	**0.033**
Time ✻ Skin Color	COVID-19 - Pre-COVID-19 ✻ White - Non- White	-0.756	0.30	-1.342	-0.169	1372.843	-2.518	**0.011**

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Time ✻ Cash Transfer	COVID-19 - Pre-COVID-19 ✻ No - Yes	0.848	0.37	0.110	1.587	1372.849	2.247	**0.024**
Time ✻ SES Score	COVID-19 - Pre-COVID-19 ✻ SES Score	-0.058	0.03	-0.122	0.004	1373.476	-1.811	0.070
Time ✻ Difficulty distancing	COVID-19 - Pre-COVID-19 ✻ No - Yes	-1.632	0.36	-2.353	-0.910	1372.872	-4.420	**<.001**
Time ✻ COVID-19 finance impact	COVID-19 - Pre-COVID-19 ✻ No - Yes	-0.756	0.30	-1.353	-0.158	1372.857	-2.472	**0.013**
Time ✻ Exposure to COVID-19	COVID-19 - Pre-COVID-19 ✻ No - Yes	-1.477	0.44	-2.355	-0.599	1372.946	-3.287	**0.001**
Post-hoc Comparison								

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Time	Difficulty distancing	Time	Difficulty distancing	Difference	SE	t	df	$P_{Bonferroni}$
COVID-19	No	Pre-COVID-19	No	-1.334	0.303	-4.401	1762	**<.001**
COVID-19	No	COVID-19	Yes	-3.407	0.413	-8.246	2018	**<.001**
COVID-19	No	Pre-COVID-19	Yes	-3.109	0.487	-6.388	2571	**<.001**
Pre-COVID-19	No	COVID-19	Yes	-2.073	0.484	-4.284	2580	**<.001**
Pre-COVID-19	No	Pre-COVID-19	Yes	-1.775	0.413	-4.296	2018	**<.001**
Time	**Exposure to COVID-19**	**Time**	**Exposure to COVID-19**	**Difference**	**SE**	**t**	**df**	**$P_{Bonferroni}$**
COVID-19	No	Pre-COVID-19	No	-1.257	0.271	-4.637	1851	**<.001**
COVID-19	No	COVID-19	Yes	-1.664	0.505	-3.295	2014	**0.006**

Number of observations: 2770; Participants included n=1385, R-square: 0.661, Random Components ICC: 0.609

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Impact of sociodemographic and COVID-19 Pandemic-related risk factors on Pre vs COVID-19 waves changes in Mental Well-being

The main effect of time for mental well-being as measured by the SWEMWBS was not significant (Estimate = 0.262, t = 1.412, p = 0.158) (Table S5). Significant interactions emerged for the effects of time-by-COVID-19 Financial Impact (Estimate = 7.381, t = 2.199, p = 0.028), see Supplemental Results for significant post-hoc comparisons), time-by-COVID-19 Cash Transfer Program Participation (Estimate = -9.875, t = -2.392, p = 0.016), time-by-Skin color (Estimate = 6.491, t = 1.971, p = 0.048), time-by-Site (Estimate = -0.918, t = 0.413, p = 0.026), and time-by-Educational level at Higher Education group (Estimate = -9.891, t = -2.940, p = 0.003). Unlike what we observed for the SDQ, there were no significant interactions of time-by-Difficulty Distancing (p=0.476), and time-by-Exposure to COVID-19 Infection (p=0.263). Additionally, the time-by-Educational level at the High school group and time-by-SES interactions were also not significant (Table 3).

Unpacking the significant time-by-Cash Transfer Program Participation interaction showed that the group who did not receive any government aid until the day of the COVID-19 wave interview showed a decrease in SWEMWBS scores from the pre-COVID-19 to COVID-19 wave (Mean Difference: -0.88, s.e. 0.320, $P_{Bonferroni}$ = 0.034), as shown in Figure 1C.

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Table 3 Main model for pre-COVID-19 and pandemic-related predictors on mental well-being as measured by the Short Warwick-Edinburgh Mental Well-being Scale

				95% Confidence Interval				
Names	**Effect**	**Estimate**	**SE**	**Lower**	**Upper**	**df**	**t**	**p**
(Intercept)	(Intercept)	25.543	1.47	22.668	28.418	1663.452	17.348	**<.001**
Time	COVID-19 - Pre-COVID-19	-1.573	0.79	-3.122	-0.023	1390.170	-1.983	**0.047**
Gender	Male - Female	-2.126	0.29	-2.700	-1.552	2343.218	-7.235	**<.001**
Skin color	White - Non-white	-0.043	0.29	-0.628	0.541	2342.816	-0.146	0.883
Age at Evaluation	Age at Evaluation	-0.005	0.06	-0.134	0.124	1472.643	-0.077	0.938
SES Score	SES Score	0.026	0.03	-0.037	0.089	2343.126	0.799	0.424
Site	Porto Alegre City - São Paulo City	0.029	0.30	-0.573	0.632	2328.708	0.095	0.924

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Educational Level	Low/Unknown education - High School	-0.005	0.34	-0.677	0.665	2340.465	-0.017	0.986
Educational Level	Low/Unknown education - Higher Education	0.319	0.49	-0.645	1.284	2297.754	0.647	0.517
COVID-19 finance impact	No - Yes	-0.916	0.30	-1.513	-0.319	2340.085	-2.997	**0.002**
Exposure to COVID-19	No - Yes	-0.597	0.44	-1.476	0.280	2336.616	-1.329	0.184
Difficulty distancing	No - Yes	-1.380	0.36	-2.097	-0.662	2343.067	-3.754	**<.001**
Cash Transfer	No - Yes	0.680	0.37	-0.058	1.418	2330.278	1.797	0.072
Time ✻ Gender	COVID-19 - Pre-COVID-19 ✻ Male - Female	0.239	0.32	-0.391	0.870	1356.011	0.740	0.459

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Time ✻ Skin Color	COVID-19 - Pre-COVID-19 ✻ White – Non-white	0.649	0.32	0.005	1.292	1355.994	1.971	**0.048**
Time ✻ Site	Porto Alegre City - São Paulo City	-0.989	0.33	-1.646	-0.331	1356.138	-2.940	**0.003**
Time ✻ Educational Level	Low/Unknown education - Higher Education	1.803	0.52	0.771	2.836	1356.541	3.412	**<.001**
Time ✻ Cash Transfer	COVID-19 - Pre-COVID-19 ✻ No - Yes	-0.987	0.41	-1.793	-0.181	1355.995	-2.392	**0.016**
Time ✻ SES Score	COVID-19 - Pre-COVID-19 ✻ SES Score	0.047	0.03	-0.022	0.117	1356.425	1.323	0.186

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Time ✻ Difficulty distancing	COVID-19 - Pre-COVID-19 ✻ No - Yes	0.287	0.40	-0.501	1.077	1356.009	0.713	0.476
Time ✻ COVID-19 finance impact	COVID-19 - Pre-COVID-19 ✻ No - Yes	0.738	0.33	0.082	1.393	1356.000	2.199	**0.028**
Time ✻ Exposure to COVID-19	COVID-19 - Pre-COVID-19 ✻ No - Yes	0.551	0.49	-0.410	1.513	1356.067	1.120	0.263

Post hoc Comparison

Time	**Cash Transfer**	**Time**	**Cash Transfer**	**Difference**	**SE**	**t**	**df**	**$P_{Bonferroni}$**
COVID-19	No	Pre-COVID-19	No	-0.886	0.320	-2.766	1601	**0.034**

*Model 2: Number of Obs: 2734, groups: ident 1367, R-square: 0.434, Random Components ICC: 0.396.

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Exploratory Analysis - Ecological Momentary Assessment

Exploratory analyses using EMA showed a significant effect of emergency cash transfer program participation across time (time-by-Emergency Cash Transfer Program Participation interaction estimate = 0.330, t = 5.256, p <0.001). Post-hoc analyses revealed that participants who received money from the COVID-19-related emergency cash transfer program reported feeling more positively throughout the day (i.e., more “thumbs up” ratings) during the COVID-19 wave, compared to their daily ratings during the pre-COVID-19 wave (Mean Difference: -0.254, s.e. 0.085, $P_{Bonferroni}$ = 0.016)(Figure 1D).

Sensitivity Analysis

Similar findings emerged when restricting our main analyses to interviews that were completed within the first six months following the onset of the COVID-19 pandemic, for both mental health problems (Table S7) and mental well-being (Table S8) outcomes.

Discussion

This is one of the few longitudinal studies to assess the impact of the COVID-19 pandemic on the mental health and well-being of youth in South America.[6] Overall, we found a modest decrease in mental health problem scale scores from pre- to during-COVID-19 pandemic onset. That said, several sociodemographic and COVID-related factors were associated with higher levels of mental health problems during the pandemic, such as experiencing a negative financial impact due to the COVID-19 pandemic (e.g., housing and food insecurity). Interestingly, mental health problems significantly decreased from the pre-COVID-19 wave to the COVID-19 wave among participants who reported: *i. not* being exposed to COVID-19 infection or *ii. not* facing difficulties in adhering to social distancing policies. Scores for the mental well-being scale did not show a statistically significant change from the pre-COVID-19 to COVID-19 wave for the whole sample, but participants who were not enrolled in the emergency cash transfer program showed lower mental well-being scale scores during the pandemic. An exploratory analysis using EMA and a small sub-sample, extended this finding by showing higher mental well-being scale scores among those who participated in the emergency cash transfer program.

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The present study is the first to report on pre- to during-COVID-19 onset mental health changes from the longitudinal BHRC study,[19] a Brazilian developmental cohort established in 2009. This compliments a recently published systematic review on longitudinal studies investigating changes in emotional symptoms from pre- to post-pandemic onset in children and adolescents, which identified 53 unique reports, representing 12 countries from North America, Europe, and Asia.[6] It is troubling that this report did not identify any study from Latin America fulfilling the criteria for their systematic review.

The present data in youth are consistent with a large Brazilian adult cohort that found no significant changes in psychiatric symptoms from pre- to during-COVID-19 pandemic onset,[4] – actually, documenting continued decreases in global psychopathology across three evaluations during the first year of the pandemic.[4]

The modest decrease in symptoms we observed is in contrast to the meta-analytic finding of Madigan et al. (2023),[6] who documented an increase in mental health problems during the pandemic. That said, we note that our results do align with those of Madigan et al. (2023), in that they found that pandemic-related negative effects on mental health were inversely correlated with income – individuals from lower income backgrounds tended not to show these effects,[6] similar to our sample. Our findings also fit with a longitudinal research study from China,[23] another low- to middle-income country, which identified either decreasing or no significant changes in mental health symptoms over time during the pandemic. Taken together, it is clear that economic background must be considered when assessing the impact of a global health emergency, such as the COVID-19 pandemic. Our findings suggest that participants who did not experience negative pandemic-related factors were possibly 'protected' from greater mental health problems during the pandemic.

In our study, we did not find an association between exposure to COVID-19 infection and an increase in mental health problems or a decrease in mental well-being. It is important to note that our 'exposure to COVID-19 infection' variable was assessed through self-report, which may have over- or under-estimated infected cases and failed to capture this association. Conversely, the group that was not exposed to COVID-19 infection exhibited lower mental health problems during the pandemic compared to those who were exposed,

and also showed a statistically significant decrease in these symptoms from the pre- to during-COVID-19 wave measurements. This group may have been protected from negative psychosocial mechanisms associated with COVID-19 infection, such as fear of dying or of developing a severe infection, and fear or guilt of spreading COVID-19 to loved ones.[24]

Several markers of the deleterious economic impact of COVID-19 were associated with increased mental health problems and decreased mental well-being during the pandemic, even after adjusting for the effect of basal SES level. For instance, a systematic review found that socioeconomically disadvantaged youth are up to three times more likely to develop a mental health condition.[25] Moreover, the role of poverty and financial hardship as causal mechanisms for increased mental health symptoms has been well established.[26] The present finding calls attention to potential societal preventive measures that go beyond psychological interventions. Previously, Lund et al. called for further investigation of the role monetary aid programs could play in alleviating the impact of poverty and economic inequalities on mental health.[27] Since then, strong evidence supports a role for such programs,[18,26,28] but few of these studies were conducted during the COVID-19 pandemic. For instance, a recent large study found that the introduction of the Brazilian national cash transfer program ('Bolsa Familia'), was associated with a reduction in suicide rates.[29] Corroborating this finding, we present novel evidence showing that participants who were not enrolled in a national COVID-19 emergency cash transfer program presented with decreased mental well-being scores measured from pre- to during-COVID-19 pandemic onset. Overall, our findings provide preliminary evidence for the role of an emergency cash transfer strategy as a potential tool to promote mental well-being and mitigate mental health problems in youth populations during crisis periods, a topic worthy of further investigation.[30]

On a related note, our exploratory analysis using EMA found that participants who received cash from the COVID-19-related emergency program showed a longitudinal increase in endorsing "feeling well" (i.e., more "thumbs up" smartphone ratings). EMA can capture phenotypic aspects that go beyond the typical 'questionnaire' approach, which was particularly relevant during the isolation associated with the pandemic. This methodology allowed us to capture

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real-time changes, which minimize recall bias, to maximize ecological validity – thereby enabling the investigation of real-world contexts that influenced participants' perceptions over time. Although EMA data were derived from a single-item question answered in naturalistic, uncontrolled environments, this approach is consistent with prior EMA research showing that brief, momentary self-reports can provide meaningful information on subjective well-being and affective states.[30] Single-item EMA measures are particularly suited to capturing within-person fluctuations over time rather than absolute levels of well-being, complementing traditional questionnaire-based assessments. In the present study, EMA findings were interpreted as exploratory and were used to contextualize changes in daily affect, rather than to replace validated multi-item well-being scales.

It is important to note the study's limitations. First, the cash transfer program findings should be interpreted with caution since we analyzed data from a community-level observational cohort, which was not designed to test any specific intervention for the COVID-19 crisis . Second, several findings relied on self-reported data, including COVID-19 exposure, economic impact, and adherence to distancing recommendations. Third, although EMA methodology provided data for a week in both pre-COVID-19 and COVID-19 waves, we did not collect data during other COVID-19 waves, such as the second major COVID-19 wave that impacted Brazilian population in April 2021. That said, our data add to the growing number of studies examining longitudinal changes in mental health in the pandemic period.[4] Fourth, given the nature of the relatively brief online data collection protocol for the COVID-19 wave, we were not able to collect data on specific sociodemographic variables at that timepoint, such as number of household members. Information on youth educational level was therefore derived from the pre-COVID-19 assessment and included in all analyses.

In this cohort study, we observed a modest decrease in mental health problems during the COVID-19 pandemic for the entire cohort, and a significant decrease in participants who were not exposed to COVID-19 infection. Thus, direct factors associated with COVID-19 (e.g., exposure to infection) and related factors (e.g., housing and food insecurity, difficulty in adhering to social distancing) moderated the impact of the pandemic on mental health problems

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among young people. Our findings showing positive effects of an emergency cash transfer program warrant future studies on societal interventions to mitigate mental health issues and increase well-being in youth during a crisis period.

Author contributions

Francisco da Silva Junior: Conceptualization; Formal analysis; Methodology; Validation; Visualization; Writing – original draft; Writing – review & editing. Rodolfo Furlan Damiano: Conceptualization; Methodology; Validation; Writing – original draft; Writing – review & editing. Letícia Müller Haas; Methodology; Writing – review & editing. Sahâmia Martins Ribeiro; Writing – review & editing. Carina de Giusti: Resources; Writing – review & editing. Laila Oliveira de Souza: Resources; Writing – review & editing. Maurício Scopel Hoffmann: Data curation; Writing – review & editing. Orestes Vicente Forlenza: Writing – review & editing. Ana Beatriz Ravagnani Salto: Writing – review & editing. Luís Augusto Rohde: Writing – review & editing. Rodrigo Affonseca Bressan; Funding acquisition; Writing – review & editing. Eurípedes Constantino Miguel; Funding acquisition; Writing – review & editing. Giovani A. Salum: Data curation; Resources; Writing – review & editing. Pedro Mario Pan: Conceptualization; Formal analysis; Methodology; Project administration; Resources; Supervision; Validation; Writing – review & editing.

Acknowledgments

We are grateful for the support provided by the National Institute of Developmental Psychiatry for Children and Adolescents (INPD), funded by Brazilian government agencies including FAPESP (#2014/50917-0; #2013/08531-5), CNPq (#465550/2014-2), the Thematic Research Project (FAPESP #2021/05332-8), and the Center for Research and Innovation in Mental Health (CISM, FAPESP #2021/12901-9).

We also acknowledge FAPESP Grant COVID #2020/06172-1, which enabled the COVID-19 wave of the BHRC, including the development of an Ecological Momentary Assessment app.

Edited by: Dr. Lais Razza

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SUPPLEMENTARY MATERIAL

Supplementary Methods

Figure S1 Histogram of youth's assessment dates before the pandemic

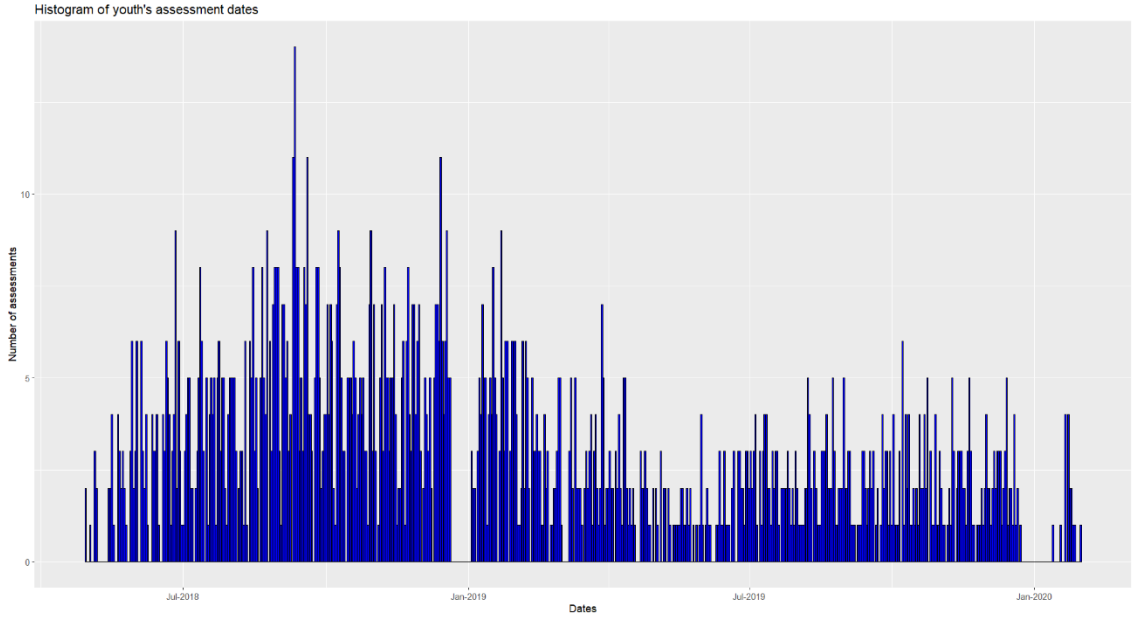
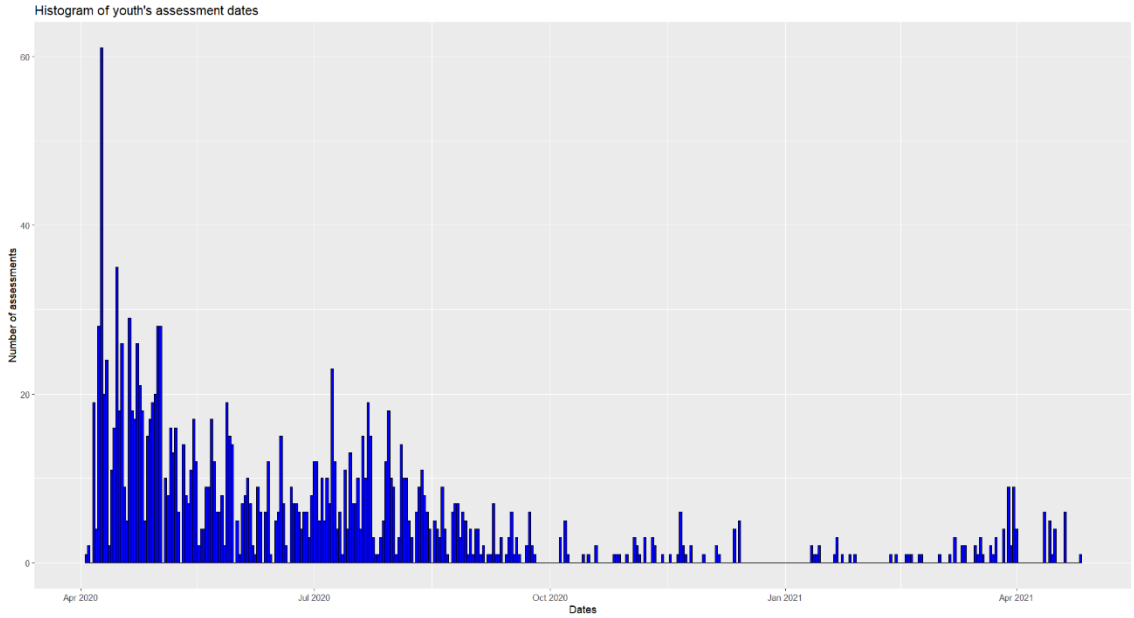


Figure S2 Histogram of youth's assessment dates during the pandemic



Choice of primary outcome measure

The two main outcomes of the present analyses are youth participants' self-reported mental health problems as reported using the Strengths and Difficulties Questionnaire (SDQ) and their mental well-being as reported using the Short Warwick-Edinburgh Mental Well-being Scale (SWEMWBS), both the pre-COVID-19 and COVID-19 waves.

Strengths and Difficulties Questionnaire (SDQ) (herein, mental health problems)

Participants were administered the Brazilian Portuguese version of the 25-item self-report version of the SDQ,[1] a widely used research instrument for the detection of emotional and behavioral problems. Each item must be rated as: Not True (0), Somewhat True (1), or Certainly True (2). Only one option can be checked per item. Here, we used the Total Difficulties score, including 20 items ranging from 0 to 40 points. Higher scores indicate more mental health problems reported by the youth. These measures are widely acknowledged in youth mental health research and have been considered as a great tool to screen mental health problems in youth.[2] The SDQ is freely available and requires minimal training for administration, making it highly accessible for researchers and clinicians alike. The implementation of the SDQ is straightforward and not time-consuming, taking approximately 5-10 minutes to complete. Higher scores in the SDQ can indicate increased severity of mental health issues, which on the scale is classified as “normal,” “borderline,” and “abnormal,” intensifying the risk of some diagnostic mental disorders such as anxiety and depression. Usually, the score distributions in large populations have shown that more than 20 points in the scales of mental health problems are related to an abnormal score symptom which is clinically significant for identifying at-risk youth with mental disorders.[2]

Short Warwick-Edinburgh Mental Well-being Scale (herein, mental well-being)

We assessed mental well-being using the Brazilian Portuguese version of the Short Warwick-Edinburgh Mental Well-being Scale (SWEMWBS), a 7-item self-reported instrument. It was specially developed to measure mental well-being in non-clinical samples. The SWEMWBS covers two different aspects of mental well-being: affect, such as the subjective experience of happiness and life satisfaction (hedonia), and psychological functioning (eudaimonia). Each item must be rated on a Likert scale from 1 to 5, from 1 “None of the time” to 5 “All of the time.” Scores range between 7-35, and higher scores indicate better levels of mental well-being. Changes in SWEMWBS scores reflect variations in an individual’s mental well-being and have been found important in providing insights into how this dimension can exist in individuals with some mental illness and their overall psychological health and resilience.[3] Twenty subjects did not complete all SWEMWBS questions and were excluded from analyses involving this outcome (therefore, n=1367 for models with mental well-being as the outcome). Both instruments have been translated and culturally adapted for use in Brazil, ensuring that they maintain their validity when used in this context.

Participation via telephone versus internet questionnaire assessment during COVID-19

Participants providing data via telephone were more likely to be from Porto Alegre city (67.0% vs 58.7%; chi-square 11.827, p<.001) and to be male (64.9% vs 60.1%; chi-square 4.093, p =.043). Mean age did not significantly differ between

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telephone and internet assessment (internet, 19.8 s.d. 1.89 years vs telephone, 19.8 s.d. 1.92 years, t=0.092, p=927).

Socioeconomic and Demographic Factors

We followed specific demographic factors: age at evaluation was calculated using birth and evaluation dates and socioeconomic status (SES) score was rated only in the pre-COVID-19 wave, using a standard Brazilian questionnaire reported by caregivers/parents.[4] Sex assigned at birth and their child's ethnicity (White, Black, Brown ["pardo"], Indigenous, and Asian; dichotomized White and non-White) was reported by a biological parent at cohort baseline. For this study, we dichotomized ethnicity into white and non-White participants.

Educational level was categorized into three groups: (1) Low/Unknown education (participants with elementary schooling, unfinished education, or missing information), (2) High school, and (3) Higher education (technical, technologist, or university level). This variable was used as a covariate in the analyses to account for potential confounding effects of educational attainment.

Exposure to COVID-19

Exposure to COVID-19 was computed using the following two variables from the CRISIS interview, which were ascertained for the last two-week period: 'Have you been exposed to someone likely to have Coronavirus/COVID-19? (Yes, someone with a positive test/Yes, someone with medical diagnosis, but no test/Yes, someone with possible symptoms, but no diagnosis by doctor vs No, not to my knowledge) and 'Have you been suspected of having Coronavirus/COVID-19 infection? (Yes, has positive test/Yes, medical diagnosis, but no test/Yes, have had some possible symptoms, but no diagnosis by doctor vs. No symptoms or signs'). A positive rating to either question was computed into a single dichotomous variable: 'Exposure to COVID-19 (yes vs no).' Importantly, most of the present data were collected at the beginning of the pandemic, when COVID-19 tests were scarce and prioritized to inpatient cases in Brazil.

COVID-19 Pandemic-related Socioeconomic Impact

Four questions from the CRISIS interview inquired specifically about potential negative socioeconomic effects of COVID-19. The questions inquired for the last 2-week period, and were dichotomized as follows: Housing Instability Concern ('To what degree are you concerned about the stability of your living situation? Very/Extremely vs. No/Slightly/Moderately'); Financial Difficulty ('To what degree have changes related to the Coronavirus/COVID-19 crisis in your area created financial problems for you or your family? Very/Extremely vs. Not at all/Slightly/Moderately'); Reduced ability to earn money ('Have any of the following happened to your family members because of the Coronavirus/COVID-19: Has your ability to earn money been impaired?: Yes/No/Not Applicable'.). We computed an 'Any COVID-19 financial impact' variable by summing these questions, considering a positive report if at least one of the questions was answered as 'yes'.

Positive Changes

One CRISIS item investigated whether there were any positive changes in participants' lives after the COVID-19 pandemic began: ´Has the Coronavirus/COVID-19 crisis in your area led to any positive changes in your life? (Some/Only a few *vs* None').

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Difficulties in Adhering to Social Distancing Measures (Difficulty Distancing)

The interview included a question on problems faced by individuals when trying to adhere to social distancing measures: ('How much difficulty have you had following the recommendations for keeping away from close contact with people? None/A little/Moderate vs A lot/A great amount'). We dichotomized this variable into 'Difficulty Distancing:' No (none, little difficulties, or moderate) and Yes (a lot or great amount).

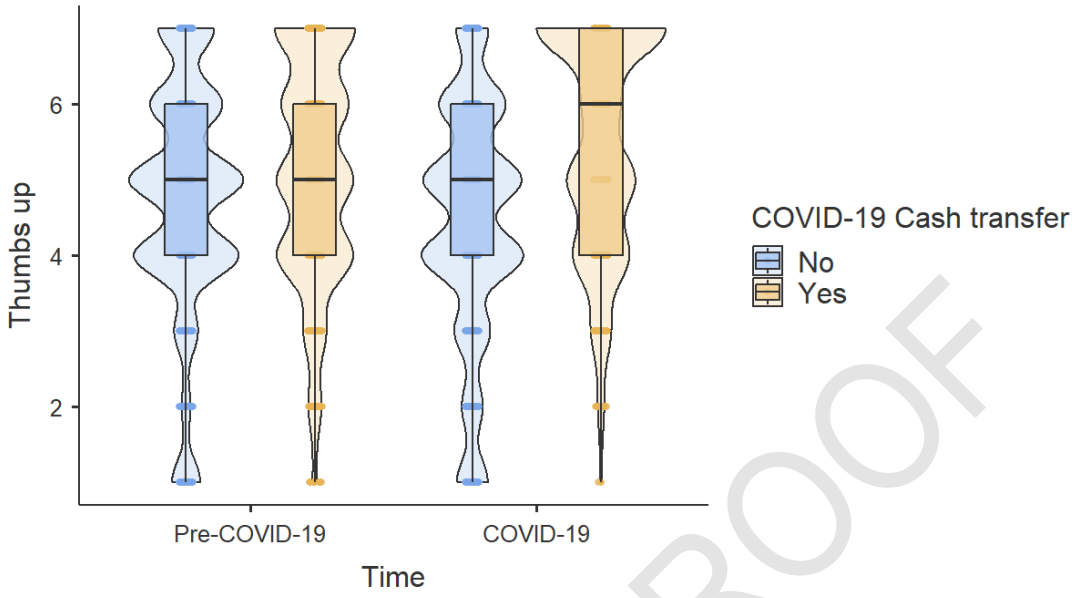
Exploratory Analysis - Ecological Momentary Assessment

The BHRCS EMA App was developed in partnership with a local technology company for the pre-COVID-19 wave and was then refurbished for the COVID-19 wave via a specific COVID-19 emergency grant. The app collected real-time data on mental health symptoms through up to 5 daily smartphone prompts over a 14-day period. Participants were instructed to download the app from Google and Apple Stores on their own devices. No monetary or reward incentive was offered for completing EMA, and the app did not provide any feedback based on participants' responses. For the COVID-19 wave App version, we introduced a button for contacting the research team if necessary. A detailed description of the EMA software and methodology can be found on the BHRC website (https://osf.io/ktz5h/).

Most app features were translated and adapted from previous EMA initiatives, such as the mMARCH protocol and the Urban Mind smartphone-based tool.5,6 However, for the present exploratory analysis, we focused on an intuitive item developed by the BHCR team in a 2018 EMA protocol: "How do you feel now?", which could be rated graphically between three thumbs up and three thumbs down. This question was then rated as a 1-7 Likert scale (e.g., one thumb up and thumb down = 4)(please see Supplemental Methods for pictures of App screenshots). Missing data and adherence to EMA participation are the main methodological issues in the field.7 The adherence to BHRC EMA was relatively low for both pre-COVID-19 and COVID-19 waves. The main reasons reported included technological (e.g., outdated devices/systems without storage or processing capacities), internet access (e.g., pay-per-use data contracts with providers, no access to free Wi-fi), and engagement issues (e.g., no feedback from the App). Therefore, we restricted this exploratory analysis to participants who provided at least 7 responses to EMA prompts at each wave. We were able to retain 64 participants who met these criteria who provided a total of 6.121 observations.

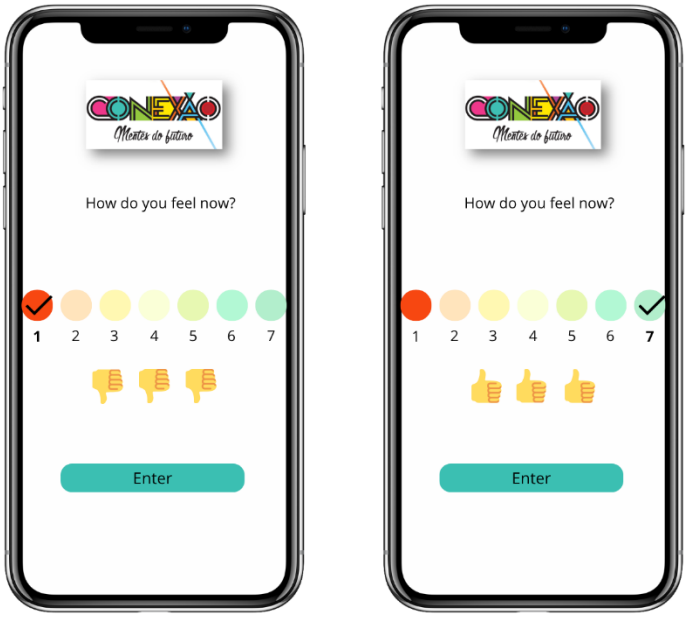
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Figure S3 Violin plot figure: Exploratory Analysis (EMA) - Differences from pre- to post-COVID-19 onset waves and the effect of an emergency cash transfer program on the mental well-being of young people using Ecological Momentary Assessment (EMA).



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Figure S4 Smartphone-based Ecological Momentary Assessment of Daily Well-being



Note: Illustration of the BHRCS EMA app interface. Participants reported their momentary emotional state in response to the question “How do you feel now?” using a 1–7 Likert scale depicted by icons ranging from three thumbs down to three thumbs up. The app prompted up to five assessments per day over a 14-day period to capture real-time variations in mood.

Supplementary Results

Attrition Analyses

When compared to participants who only reported data for the pre-COVID-19 wave, participants who provided data in both waves were younger (p=0.03), of a higher socioeconomic status (SES) (p<0,01), and more likely to be from the São Paulo site (p<0.01) (Supplemental Table S1). Moreover, in comparison to the baseline sample (N=2511, Year 2010), participants included in the present analysis (n=1385) were more likely to be from the São Paulo site (p=0.02), female (p<0.01), and of a higher SES at cohort baseline (p<0.01) (Table S2). Finally, when we compared those who participated in the pre-COVID-19 wave but not in the COVID-19 wave (n=322) vs. those who participated in the COVID-19 wave but not pre-COVID-19 wave (n=210), this latter group was more likely to be from São Paulo site (p<0.01), of a higher SES at cohort baseline (p=0.02) and to have lower parent-reported SDQ Total Difficulties Scores at baseline (p=0.03) (Table S3).

Supplementary Table S1: Attrition Analysis 1 - Comparing participants who only reported data for Pre-COVID-19 wave with participants who provided data for both pre- and COVID-19

Variable	N	Responded in both waves	Responded only in the pre-COVID-19 wave (Missings)	Test Statistic
		N=1385 (%)	N=322 (%)	
Gender: Feminine	1707	(48.0%) 665/1385	(43.8%) 141/322	X_1^2=1.87, P=0.17
Age at Pre-COVID wave	1707	**16.8 18.3 19.9**	**17.1 18.6 20.2**	**P^2=0.028**
Site: São Paulo	1707	**(52.2%) 723/1385**	**(36.6%) 118/322**	**X_1^2=25.29, P<0.01**
Socioeconomic status at cohort baseline	1707	**15.0 18.0 21.0**	**15.0 17.0 21.0**	**P^2=<.001**
SDQ youth self-report at Pre-COVID-19 wave	1707	10.0 **14.0** 19.0	9.0 **15.0** 20.0	P^2=0.560

SDQ - Strengths and Difficulties Questionnaire; In the numerical variables, the middle number is the median, on the left the 1st quartile, and on the right the 3rd quartile . 1Pearson Chi-square. 2Mann-Whitney.

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Supplementary Table S2: Attrition Analysis 2- Comparing participants who provided data for both pre-and COVID-19 with all other participants at the BHRC cohort study baseline.

Variable	N	Responded in both pre- and COVID-19 waves	Did not Responded in both pre- and COVID-19 waves	Test Statistic
		(N=1385)	(N=1126)	
Gender: Feminine	2511	**(48.0%) 665/1385**	**(41.8%) 471/1126**	**X_1^2=9.59, P<0.01**
Age at BHRC baseline, mean years, SD	2511	8.7 **10.1** 11.6	8.7 **10.3** 11.7	P^2=0.30
Site: São Paulo	2511	**(52.2%) 723/1385**	**(47.3%) 533/1126**	**X_1^2=5.88, P=0.02**
Socioeconomic status at cohort baseline, mean SD	2511	**15.0 18.0 21.0**	**15.0 18.0 21.0**	**P^2=0.002**
SDQ parent-report at BHRC baseline, mean SD	2511	8.0 **14.0** 21.0	9.0 **15.0** 21.0	P^2=0.251

N is the number of non-missing values. In the numerical variables, the middle number is the median, on the left the 1st quartile, and on the right the 3rd quartile. 1Pearson Chi-square. 2Mann-Whitney.

Supplementary Table S3 Missing Data: Pre-COVID-19 AND During COVID-19

Variable	N	Responded to pre-COVID-19 wave but not during COVID-19 wave	Responded to COVID-19 wave but not pre-COVID-19 wave	Test Statistic
		(N=322)	(N=210)	
Gender: Feminine	532	(43.8%) 141/322	(44.3%) 93/210	X_1^2=0.01, P=0.91
Age at BHRC baseline	532	9.0 **10.3** 11.8	8.6 **10.3** 11.8	P^2=0.247
Site: São Paulo	532	**(36.6%) 118/322**	**(60.5%) 127/210**	**X_1^2=29.05, P<0.01**
Socioeconomic status at cohort baseline	532	**15.0 17.0 21.0**	**16.0 18.0 21.0**	**P^2=0.018**
SDQ parent-report at BHRC baseline	532	**10.0 15.0 21.1**	**8.0 14.0 20.0**	**P^2=0.028**

N is the number of non-missing value. In the numerical variables, the middle number is the median, on the left the 1st quartile, and on the right the 3rd quartile. 1Pearson Chi-square. 2Mann-Whitney.

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Table S4: Mixed model for COVID-19 predictors on mental health problems without the interactions

				95% Confidence Interval				
Names	**Effect**	**Estimate**	**SE**	**Lower**	**Upper**	**df**	**t**	**p**
(Intercept)	(Intercept)	6.842	1.68	3.561	10.136	1538.738	4.068	**<.001**
Time	COVID-19 – Pre-COVID-19	1.256	0.18	0.892	1.618	2501.666	6.782	**<.001**
Gender	Male – Female	3.381	0.29	2.805	3.958	1372.089	11.460	**<.001**
Skin color	White – Non-white	-0.480	0.30	-1.067	0.106	1372.171	-1.597	0.110
Age at Evaluation	Age at Evaluation	0.319	0.07	0.166	0.471	1570.867	4.094	**<.001**
SES Score	SES Score	-0.040	0.03	-0.104	0.023	1372.202	-1.247	0.212
Site	Porto Alegre City – São Paulo City	-0.035	0.31	-0.644	0.572	1376.290	-0.114	0.909
Educational Level	Low/Unknown – High School	-1.662	0.34	-2.336	-0.989	1373.125	-4.820	**<.001**
Educational Level	Low/Unknown – Higher Education	-2.855	0.50	-3.837	-1.872	1386.499	-5.678	**<.001**
COVID-19 finance impact	No – Yes	0.939	0.30	0.339	1.539	1373.175	3.060	**0.002**
Exposure to COVID-19	No – Yes	0.927	0.45	0.044	1.810	1373.993	2.051	**0.040**
Difficulty distancing	No – Yes	2.590	0.36	1.869	3.312	1372.134	7.009	**<.001**
Cash Transfer	No – Yes	-0.099	0.38	-0.846	0.647	1376.170	-0.260	0.795

*Model S4: Number of Obs:2770, groups: ident 1385, R-square: 0.647, Random Components ICC: 0.588

Table S5: Mixed model for COVID-19 predictors on mental well-being without the interactions

				95% Confidence Interval				
Names	**Effect**	**Estimate**	**SE**	**Lower**	**Upper**	**df**	**t**	**p**
(Intercept)	(Intercept)	24.614	1.423	21.835	27.394	1459.254	17.297	**<.001**
Time	COVID-19 – Pre-COVID-19	0.262	0.186	-0.101	0.627	2174.476	1.412	0.158
Gender	Male – Female	-2.006	0.245	-2.486	-1.527	1355.083	-8.173	**<.001**
Skin color	White – Non-white	0.280	0.250	-0.208	0.769	1355.156	1.121	0.262
Age at Evaluation	Age at Evaluation	-0.004	0.066	-0.133	0.124	1471.757	-0.068	0.946

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SES Score	SES Score	0.049	0.027	-0.003	0.102	1355.133	1.826	0.068
Site	Porto Alegre City – São Paulo City	-0.464	0.258	-0.970	0.040	1357.671	-1.797	0.072
Educational Level	Low/Unknown – High School	0.350	0.287	-0.211	0.911	1355.671	1.217	0.223
Educational Level	Low/Unknown – Higher Education	1.220	0.418	0.402	2.038	1364.047	2.915	**0.003**
COVID-19 finance impact	No – Yes	-0.547	0.255	-1.047	-0.048	1355.697	-2.142	**0.032**
Exposure to COVID-19	No – Yes	-0.322	0.376	-1.057	0.412	1356.261	-0.857	0.392
Difficulty distancing	No – Yes	-1.236	0.307	-1.835	-0.636	1355.103	-4.025	**<.001**
Cash Transfer	No – Yes	0.185	0.317	-0.433	0.805	1357.558	0.586	0.558

*Model S5: Number of Obs:2734, groups: ident 1367, R-square: 0.422, Random Components ICC: 0.388

Table S6. Mixed model for predictors of Thumbs up assessment (Ecological Momentary Assessment)

				95% Confidence Interval				
Names	**Effect**	**Estimate**	**SE**	**Lower**	**Upper**	**df**	**t**	**p**
(Intercept)	(Intercept)	1.716	1.11	-0.401	3.889	182.659	1.541	0.124
Time	COVID-19 – Pre-COVID-19	-0.076	0.06	-0.208	0.051	542.333	-1.135	0.257
Gender	Male – Female	0.787	0.26	0.277	1.298	58.515	2.938	**0.004**
Age at Evaluation	Age at Evaluation	0.036	0.04	-0.052	0.123	333.504	0.811	0.417
Educational Level	Low/Unknown – High School	-0.436	0.42	-1.243	0.369	60.616	-1.030	0.307
Educational Level	Low/Unknown – Higher Education	-0.414	0.47	-1.322	0.492	59.089	-0.870	0.387
Cash Transfer	No – Yes	-0.656	0.34	-1.313	0.002	61.131	-1.898	0.062
Time ✻ Cash Transfer	COVID-19 – Pre-COVID-19 ✻ No – Yes	0.330	0.06	0.207	0.453	6107.497	5.256	**<.001**

Post hoc Comparison

Time	**Cash Transfer**	**Time**	**Cash Transfer**	**Difference**	**SE**	**df**	**t**	**$P_{Bonferroni}$**
COVID-19	Yes	Pre-COVID-19	Yes	-0.254	0.08	Inf	-2.991	**0.016**

*Model S6: Number of Obs:6121, groups: ident 64, R-square: 0.553, Random Components ICC: 0.512

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Table S7. Model for pre-COVID-19 and pandemic-related predictors on mental health problems as measured by the Strenght and Difficulties Questionnaire with non-longitudinal significant interactions included.

				95% Confidence Interval				
Names	**Effect**	**Estimate**	**SE**	**Lower**	**Upper**	**df**	**t**	**p**
(Intercept)	(Intercept)	5.432	1.71	2.079	8.781	1666.3518	3.168	**0.001**
Time	COVID-19 - Pre-COVID-19	3.965	0.72	2.556	5.374	1430.540	5.499	**<.001**
Gender	Male - Female	3.695	0.32	3.051	4.339	2017.356	11.202	**<.001**
Skin color	White - Non-white	-0.101	0.33	-0.758	0.554	2017.178	-0.303	0.761
Age at Evaluation	Age at Evaluation	0.322	0.07	0.170	0.475	1576.511	4.136	**<.001**
SES Score	SES Score	-0.011	0.03	-0.082	0.060	2017.250	-0.305	0.760
Site	Porto Alegre City - São Paulo City	0.037	0.34	-0.641	0.716	2008.450	0.108	0.913
Educational Level	Low/Unknown education - High School	-1.619	0.38	-2.372	-0.867	2015.491	-4.203	**<.001**
Educational Level	Low/Unknown education - Higher Education	-2.787	0.55	-3.874	-1.700	1990.169	-5.007	**<.001**
COVID-19 finance impact	No - Yes	1.316	0.34	0.646	1.986	2015.254	3.838	**<.001**
Exposure to COVID-19	No - Yes	1.664	0.50	0.678	2.650	2013.316	3.295	**0.001**
Difficulty distancing	No - Yes	3.407	0.41	2.600	4.214	2017.236	8.246	**<.001**
Cash Transfer	No - Yes	-0.525	0.42	-1.358	0.306	2009.299	-1.233	0.217
Time ✻ Gender	COVID-19 - Pre-	-0.626	0.29	-1.202	-0.050	1372.867	-2.126	**0.033**

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	COVID-19 ✻ Male - Female							
Time ✻ Skin Color	COVID-19 - Pre-COVID-19 ✻ White - Non- White	-0.756	0.30	-1.342	-0.169	1372.843	-2.518	**0.011**
Time ✻ Cash Transfer	COVID-19 - Pre-COVID-19 ✻ No - Yes	0.848	0.37	0.110	1.587	1372.849	2.247	**0.024**
Time ✻ SES Score	COVID-19 - Pre-COVID-19 ✻ SES Score	-0.058	0.03	-0.122	0.004	1373.476	-1.811	0.070
Time ✻ Difficulty distancing	COVID-19 - Pre-COVID-19 ✻ No - Yes	-1.632	0.36	-2.353	-0.910	1372.872	-4.420	**<.001**
Time ✻ COVID-19 finance impact	COVID-19 - Pre-COVID-19 ✻ No - Yes	-0.756	0.30	-1.353	-0.158	1372.857	-2.472	**0.013**
Time ✻ Exposure to COVID-19	COVID-19 - Pre-COVID-19 ✻ No - Yes	-1.477	0.44	-2.355	-0.599	1372.946	-3.287	**0.001**

Post hoc Comparison

Time	Difficulty distancing	Time	Difficulty distancing	Difference	SE	t	df	$P_{Bonferroni}$
COVID-19	No	Pre-COVID-19	No	-1.334	0.303	-4.401	1762	**<.001**
COVID-19	No	COVID-19	Yes	-3.407	0.413	-8.246	2018	**<.001**
COVID-19	No	Pre-COVID-19	Yes	-3.109	0.487	-6.388	2571	**<.001**
Pre-COVID-19	No	COVID-19	Yes	-2.073	0.484	-4.284	2580	**<.001**

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Pre-COVID-19	No	Pre-COVID-19	Yes	-1.775	0.413	-4.296	2018	**<.001**
Time	**Exposure to COVID-19**	**Time**	**Exposure to COVID-19**	**Difference**	**SE**	**t**	**df**	**$P_{Bonferroni}$**
COVID-19	No	Pre-COVID-19	No	-1.257	0.271	-4.637	1851	**<.001**
COVID-19	No	COVID-19	Yes	-1.664	0.505	-3.295	2014	**0.006**
Time	**Finance Impact**	**Time**	**Finance Impact**	**Difference**	**SE**	**t**	**df**	**p**
COVID-19	No	COVID-19	Yes	-1.317	0.343	-3.838	2016	**<.001**
COVID-19	No	Pre-COVID-19	Yes	-1.457	0.434	-3.361	2732	**0.004**
Time	**Gender**	**Time**	**Gender**	**Difference**	**SE**	**t**	**df**	**$P_{Bonferroni}$**
COVID-19	Male	COVID-19	Female	-3.695	0.330	-11.202	2018	**<.001**
COVID-19	Male	Pre-COVID-19	Female	-3.900	0.431	-9.055	2738	**<.001**
Pre-COVID-19	Male	COVID-19	Female	-2.864	0.432	-6.633	2736	**<.001**

Note: Number of Observations: 2770; Participants included n=1385, R-square: 0.661, Random Components ICC: 0.609

Table S8. Model for pre-COVID-19 and pandemic-related predictors on mental well-being as measured by the Short Warwick-Edinburgh Mental Well-being Scale with non-longitudinal significant interactions included.

				95% Confidence Interval				
Names	**Effect**	**Estimate**	**SE**	**Lower**	**Upper**	**df**	**t**	**p**
(Intercept)	(Intercept)	25.543	1.47	22.668	28.418	1663.452	17.348	**<.001**
Time	COVID-19 - Pre-COVID-19	-1.573	0.79	-3.122	-0.023	1390.170	-1.983	**0.047**
Gender	Male - Female	-2.126	0.29	-2.700	-1.552	2343.218	-7.235	**<.001**
Skin color	White - Non-white	-0.043	0.29	-0.628	0.541	2342.816	-0.146	0.883
Age at Evaluation	Age at Evaluation	-0.005	0.06	-0.134	0.124	1472.643	-0.077	0.938
SES Score	SES Score	0.026	0.03	-0.037		2343.126	0.799	0.424

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					0.089			
Site	Porto Alegre City - São Paulo City	0.029	0.30	-0.573	0.632	2328.708	0.095	0.924
Educational Level	Low/Unknown education - High School	-0.005	0.34	-0.677	0.665	2340.465	-0.017	0.986
Educational Level	Low/Unknown education - Higher Education	0.319	0.49	-0.645	1.284	2297.754	0.647	0.517
COVID-19 finance impact	No - Yes	-0.916	0.30	-1.513	-0.319	2340.085	-2.997	**0.002**
Exposure to COVID-19	No - Yes	-0.597	0.44	-1.476	0.280	2336.616	-1.329	0.184
Difficulty distancing	No - Yes	-1.380	0.36	-2.097	-0.662	2343.067	-3.754	**<.001**
Cash Transfer	No - Yes	0.680	0.37	-0.058	1.418	2330.278	1.797	0.072
Time ✻ Gender	COVID-19 - Pre-COVID-19 ✻ Male - Female	0.239	0.32	-0.391	0.870	1356.011	0.740	0.459
Time ✻ Skin Color	COVID-19 - Pre-COVID-19 ✻ White – Non-white	0.649	0.32	0.005	1.292	1355.994	1.971	**0.048**
Time ✻ Site	Porto Alegre City - São Paulo City	-0.989	0.33	-1.646	-0.331	1356.138	-2.940	**0.003**
Time ✻ Educational Level	Low/Unknown	1.803	0.52	0.771	2.836	1356.541	3.412	**<.001**

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	education - Higher Education							
Time ✻ Cash Transfer	COVID-19 - Pre-COVID-19 ✻ No - Yes	-0.987	0.41	-1.793	-0.181	1355.995	-2.392	**0.016**
Time ✻ SES Score	COVID-19 - Pre-COVID-19 ✻ SES Score	0.047	0.03	-0.022	0.117	1356.425	1.323	0.186
Time ✻ Difficulty distancing	COVID-19 - Pre-COVID-19 ✻ No - Yes	0.287	0.40	-0.501	1.077	1356.009	0.713	0.476
Time ✻ COVID-19 finance impact	COVID-19 - Pre-COVID-19 ✻ No - Yes	0.738	0.33	0.082	1.393	1356.000	2.199	**0.028**
Time ✻ Exposure to COVID-19	COVID-19 - Pre-COVID-19 ✻ No - Yes	0.551	0.49	-0.410	1.513	1356.067	1.120	0.263

Post hoc Comparison

Time	**Cash Transfer**	**Time**	**Cash Transfer**	**Difference**	**SE**	**t**	**df**	**$P_{Bonferroni}$**
COVID-19	No	Pre-COVID-19	No	-0.886	0.32	-2.766	1601	**0.034**
Time	**Finance Impact**	**Time**	**Finance Impact**	**Difference**	**SE**	**t**	**df**	**$P_{Bonferroni}$**
COVID-19	No	COVID-19	Yes	0.917	0.30	2.997	2340	**0.0165**
Time	**Site**	**Time**	**Site**	**Difference**	**SE**	**t**	**df**	**$P_{Bonferroni}$**
Pre	Porto Alegre City	Pre	São Paulo City	0.9599	0.30	3.112	2330	**0.0113**
Time	**Education**	**Time**	**Education**	**Difference**	**SE**	**t**	**df**	**p**
Pre	Low/Unknown	Pre	Higher Education	-2.123	0.49	-4.280	2292	**<.001**

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	education							
COVID-19	Low/Unknown education	Pre	Higher Education	-1.676	0.54	-3.069	2692	**0.0326**
COVID-19	High School	Pre	Higher Education	-1.682	0.50	-3.335	2709	**0.0130**
Pre	High School	Pre	Higher Education	-1.417	0.44	-3.188	2300	**0.0218**

*Model 2: Number of Obs: 2734, groups: ident 1367, R-square: 0.434, Random Components ICC: 0.396.

Table S9: Sensitivity Analyses - Models restricted to participants who reported data in the first 6 months of COVID-19 pandemic on mental health problems

				95% Confidence Interval				
Names	**Effect**	**Estimate**	**SE**	**Lower**	**Upper**	**df**	**t**	**p**
(Intercept)	(Intercept)	5.447	1.76	1.991	8.899	1536	3.080	**0.002**
Time	COVID-19 – Pre-COVID-19	4.058	0.74	2.612	5.503	1331	5.483	< **.001**
Gender	Male – Female	3.642	0.33	2.978	4.305	1874	10.717	< **.001**
Skin color	White – Non-white	-0.009	0.34	-0.688	0.669	1874	-0.027	0.978
Age at Evaluation	Age at Evaluation	0.309	0.08	0.151	0.466	1450	3.827	< **.001**
SES Score	SES Score	0.004	0.03	-0.067	0.077	1874	0.131	0.896
Site	Porto Alegre – São Paulo	-0.182	0.35	-0.884	0.518	1866	-0.509	0.611
Educational Level	Low/Unknown – High School	-1.590	0.39	-2.369	-0.810	1872	-3.980	< **.001**
Educational Level	Low/Unknown – Higher Education	-2.715	0.57	-3.836	-1.594	1846	-4.729	< **.001**
COVID-19 finance impact	No – Yes	1.352	0.35	0.659	2.044	1872	3.810	< **.001**
Exposure to COVID-19	No – Yes	1.469	0.52	0.440	2.496	1871	2.789	0.005
Difficulty distancing	No – Yes	3.488	0.42	2.663	4.311	1874	8.262	< **.001**
Cash Transfer	No – Yes	-0.428	0.43	-1.277	0.420	1865	-0.986	0.324
Time ✻ Gender	COVID-19 – Pre-COVID-19 ✻ Male	**-0.623**	0.302	-1.214	-0.032	1279	-2.060	**0.040**

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	– Female							
Time ✻ Skin color	COVID-19 – Pre-COVID-19 ✻ White – Non-white	**-0.778**	0.309	-1.382	-0.174	1279	-2.518	**0.012**
Time ✻ Cash Transfer	COVID-19 – Pre-COVID-19 ✻ No – Yes	**0.856**	0.383	0.108	1.604	1279	2.235	**0.026**
Time ✻ SES Score	COVID-19 – Pre-COVID-19 ✻ SES Score	**-0.071**	0.033	-0.136	-0.006	1280	-2.146	**0.032**
Time ✻ Difficulty distancing	COVID-19 – Pre-COVID-19 ✻ No – Yes	**-1.594**	0.375	-2.327	-0.860	1279	-4.242	**< .001**
Time ✻ COVID-19 finance impact	COVID-19 – Pre-COVID-19 ✻ No – Yes	**-0.690**	0.314	-1.305	-0.075	1279	-2.194	**0.028**
Time ✻ Exposure to COVID-19	COVID-19 – Pre-COVID-19 ✻ No – Yes	**-1.418**	0.466	-2.330	-0.506	1279	-3.038	**0.002**
Time ✻ Site	COVID-19 – Pre-COVID-19 ✻ Porto Alegre City – São Paulo City	**0.029**	0.316	-0.589	0.648	1279	0.093	0.926
Time ✻ Educational Level	COVID-19 – Pre-COVID-19 ✻ Low/Unknown – High School	**-0.090**	0.354	-0.783	0.602	1279	-0.256	0.798
Time ✻ Educational Level	COVID-19 – Pre-COVID-19 ✻ Low/Unknown – Higher Education	**-0.198**	0.495	-1.165	0.767	1280	-0.402	0.688

Post hoc Comparison

Time	**Gender**	**Time**	**Gender**	**Difference**	**SE**	**t**	**df**	**$P_{Bonferroni}$**
COVID-19	Male	COVID-19	Female	-3.642	0.34	-10.717	1875	**<.001**
COVID-19	Male	Pre-COVID-19	Female	-3.853	0.44	-8.731	2548	**<.001**

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Pre-COVID-19	Male	COVID-19	Female	-2.809	0.44	-6.338	2546	**<.001**
Pre-COVID-19	Male	Pre-COVID-19	Female	-3.019	0.34	-8.883	1875	**<.001**
Post hoc Comparison								
Time	**Difficulty distancing**	**Time**	**Difficulty distancing**	**Difference**	**SE**	**t**	**df**	**$P_{Bonferroni}$**
COVID-19	No	Pre-COVID-19	No	-1.319	0.31	-4.232	1626	**<.001**
COVID-19	No	COVID-19	Yes	-3.488	0.42	-8.262	1875	**<.001**
COVID-19	No	Pre-COVID-19	Yes	-3.213	0.49	-6.459	2394	**<.001**
Pre-COVID-19	No	COVID-19	Yes	-2.169	0.49	-4.388	2404	**<.001**
Pre-COVID-19	No	Pre-COVID-19	Yes	-1.894	0.42	-4.486	1875	**<.001**
Post hoc Comparison								
Time	**COVID-19 finance impact**	**Time**	**COVID-19 finance impact**	**Difference**	**SE**	**t**	**df**	**$P_{Bonferroni}$**
COVID-19	No	COVID-19	Yes	-1.352	0.35	-3.810	1872	**<.001**
COVID-19	No	Pre-COVID-19	Yes	-1.528	0.44	-3.438	2542	**0.003**
Post hoc Comparison								
Time	**Exposure to COVID-19**	**Time**	**Exposure to COVID-19**	**Difference**	**SE**	**t**	**df**	**$P_{Bonferroni}$**
COVID-19	No	Pre-COVID-19	No	-1.2314	0.275	-4.476	1728	**<.001**
COVID-19	No	COVID-19	Yes	-1.4686	0.527	-2.789	1871	**0.032**

*Model S7: Number of Observations: 2582; Participants included n=1291, R-square: 0.665, Random Components ICC: 0.604

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Table S10: Sensitivity Analyses - Models restricted to participants who reported data in the first 6 months of COVID-19 pandemic on mental well-being

				95% Confidence Interval				
Names	**Effect**	**Estimate**	**SE**	**Lower**	**Upper**	**df**	**t**	**p**
(Intercept)	(Intercept)	25.190	1.52	22.212	28.161	1534	16.528	**< .001**
Time	COVID-19 – Pre-COVID-19	-1.360	0.80	-2.927	0.208	1294	-1.694	0.091
Gender	Male – Female	-2.082	0.30	-2.672	-1.490	2150	-6.876	**< .001**
Skin color	White – Non-white	-0.197	0.30	-0.801	0.407	2149	-0.636	0.525
SES Score	SES Score	0.019	0.03	-0.046	0.084	2150	0.572	0.567
Site	Porto Alegre City – São Paulo City	0.202	0.31	-0.419	0.824	2137	0.635	0.526
Educational Level	Low/Unknown – High School	0.011	0.35	-0.684	0.707	2147	0.032	0.974
Educational Level	Low/Unknown – Higher Ed.	0.285	0.50	-0.710	1.280	2104	0.559	0.576
COVID-19 finance impact	No – Yes	-0.865	0.31	-1.482	-0.248	2146	-2.738	**0.006**
Exposure to COVID-19	No – Yes	-0.685	0.46	-1.600	0.230	2144	-1.461	0.144
Difficulty distancing	No – Yes	-1.391	0.37	-2.123	-0.657	2150	-3.704	**< .001**
Cash Transfer	No – Yes	0.705	0.38	-0.047	1.457	2135	1.828	0.068
Age at Evaluation	Age at Evaluation	0.008	0.06	-0.125	0.143	1364	0.131	0.896
Time ✻ Gender	COVID-19 – Pre-COVID-19 ✻ Male – Female	0.171	0.32	-0.466	0.809	1263	0.525	0.600
Time ✻ Skin color	COVID-19 – Pre-COVID-19 ✻ White – Non-white	0.924	0.33	0.271	1.576	1263	2.766	**0.006**
Time ✻ Cash Transfer	COVID-19 – Pre-COVID-19 ✻ No – Yes	-1.125	0.41	-1.930	-0.319	1263	-2.728	**0.006**
Time ✻ SES Score	COVID-19 – Pre-COVID-19 ✻ SES Score	0.054	0.03	-0.015	0.124	1263	1.509	0.132

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Time ✻ Difficulty distancing	COVID-19 – Pre-COVID-19 ✻ No – Yes	0.194	0.40	-0.596	0.985	1263	0.480	0.632
Time ✻ COVID-19 finance impact	COVID-19 – Pre-COVID-19 ✻ No – Yes	0.686	0.34	0.021	1.351	1263	2.017	**0.044**
Time ✻ COVID-19 exposure	COVID-19 – Pre-COVID-19 ✻ No – Yes	0.604	0.50	-0.380	1.589	1263	1.199	0.231
Time ✻ Site	COVID-19 – Pre-COVID-19 ✻ Porto Alegre City – São Paulo City	-1.144	0.34	-1.809	-0.477	1263	-3.352	**< .001**
Time ✻ Educational Level	COVID-19 – Pre-COVID-19 ✻ Low/Unknown – High School	0.579	0.38	-0.170	1.329	1263	1.510	0.131
Time ✻ Educational Level	COVID-19 – Pre-COVID-19 ✻ Low/Unknown – Higher Education	1.660	0.53	0.616	2.703	1263	3.107	**0.002**

Post hoc Comparison

Time	**Cash Transfer**	**Time**	**Cash Transfer**	**Difference**	**SE**	**t**	**df**	**$P_{Bonferroni}$**
COVID-19	No	Pre-COVID-19	No	-1.11875	0.32	-3.440	1486	**0.003**

Post hoc Comparison

Time	**COVID-19 finance impact**	**Time**	**COVID-19 finance impact**	**Difference**	**SE**	**t**	**df**	**$P_{Bonferroni}$**
COVID-19	No	COVID-19	Yes	0.8658	0.31	2.738	2146	**0.037**
Time	**Skin Color**	**Time**	**Skin Color**	**Difference**	**SE**	**t**	**df**	**$P_{Bonferroni}$**
COVID-19	Non-White	Pre-COVID-19	Non-White	-1.0184	0.38	-2.657	1422	**0.0478**
Time	**Site**	**Time**	**Site**	**Difference**	**SE**	**t**	**df**	**$P_{Bonferroni}$**
COVID-19	Porto Alegre City	Pre-COVID-19	São Paulo City	-1.1281	0.38	-2.950	1427	**0.0194**
Pre-COVID-19	Porto Alegre City	Pre-COVID-19	São Paulo City	0.9414	0.31	2.956	2138	**0.0189**
Time	**Education Level**	**Time**	**Education Level**	**Difference**	**SE**	**t**	**df**	**$P_{Bonferroni}$**

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COVID-19	Low/Unknown	Pre-COVID-19	Higher Education	-1.754	0.56	-3.136	2492	**0.026**
Pre-COVID-19	Low/Unknown	Pre-COVID-19	Higher Education	-1.945	0.51	-3.802	2100	**0.002**
COVID-19	High School	Pre-COVID-19	Higher Education	-1.743	0.51	-3.384	2517	**0.010**
Pre-COVID-19	High School	Pre-COVID-19	Higher Education	-1.353	0.45	-2.965	2108	**0.045**

*Model S8: Number of Observations: 2548; Participants included n=1274, R-square: 0.456, Random Components ICC: 0.417

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