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# COVID-19 blues: Lockdowns and mental health-related google searches in Latin America

Adan Silverio-Murillo<sup>a</sup>, Lauren Hoehn-Velasco<sup>b</sup>, Abel Rodriguez Tirado<sup>a</sup>,  
Jose Roberto Balmori de la Miyar<sup>c,\*</sup>

<sup>a</sup> School of Government, Tecnológico de Monterrey, Mexico

<sup>b</sup> Andrew Young School of Policy Studies, Georgia State University, USA

<sup>c</sup> Universidad Anahuac Mexico, Business and Economics School, Av. Universidad Anáhuac 46, Huixquilucan, 52786, Mexico

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## ABSTRACT

**Rationale:** Stress process theory considers that actual and perceived isolation, caused by mobility restrictions from attempted containment of the COVID-19 pandemic, deteriorates mental health.

**Objective:** We examine the relationship between the COVID-19 lockdowns and mental health-related Google searches in 11 Latin American countries. We include the following countries: Argentina, Bolivia, Chile, Colombia, Ecuador, Guatemala, Honduras, Mexico, Paraguay, Peru, and Uruguay. We also explore how changes in search patterns relate to income support policies and to COVID-19 death rates.

**Method:** Using Google Trends data and an event-study design, as well as a difference-in-differences analysis, we investigate the association between country specific stay-at-home orders and internet searches including the following words: insomnia, stress, anxiety, sadness, depression, and suicide.

**Results:** We find three main patterns. First, searches for insomnia peak but then decline. Second, searches for stress, anxiety, and sadness increase and remain high throughout the lockdown. Third, there is no substantial change in depression-related or suicide-related searches after the lockdown. In terms of potential mechanisms, our results suggest that searches declined for suicide and insomnia following the passage of each country's income support, while in countries with higher COVID-19-related death rates, searches for insomnia, stress, and anxiety increased by more.

**Conclusions:** Our results suggest that, in Latin America, Google searches for words associated with mild mental health disorders increased during the COVID-19 stay-at-home orders. Nonetheless, these conclusions should not be construed as a general population mental health deterioration, as we cannot verify that search indicators are accurately related to the users' current feelings and behaviors, and as internet users may not be representative of the population in this region.

## 1. Introduction

Does the COVID-19 pandemic affect mental health? Mobility restrictions from attempted containment of the COVID-19 pandemic may reduce virus transmission, but these restrictions may increase anxiety and stress over future income and employment (De Castro Ribeiro, 2020). Individuals may also face direct fear of infection, for themselves, their family, or their friends. This fear of infection may increase both stress and anxiety throughout the pandemic. Conversely, the stay-at-home orders may improve mental health due to extended time

spent together with household members and the decline in commuting-related stress (The Guardian, 2020). Further, when individuals' lives are at risk, they may place a higher value on their own lives, which may translate into reduced suicidal ideation (Reger et al., 2020).

Stress process theory considers both of the scenarios mentioned above. On the one hand, this theory points to stressors such as adverse events as the primary mechanism for negative mental health effects (Thoits, 2010). Further, actual and perceived isolation can accelerate the detrimental impacts, including mental illnesses (Holt-Lunstad et al.,

\* Corresponding author.

E-mail addresses: [adan.sm@tec.mx](mailto:adan.sm@tec.mx) (A. Silverio-Murillo), [lvelasco@gsu.edu](mailto:lvelasco@gsu.edu) (L. Hoehn-Velasco), [a01595062@itesm.mx](mailto:a01595062@itesm.mx) (A. Rodriguez Tirado), [jose.balmori@anahuac.mx](mailto:jose.balmori@anahuac.mx) (J.R. Balmori de la Miyar).

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2015). On the other hand, stress process theory also suggests alternative mechanisms through which extended time with family or other meaningful social relationships improve psychological well-being (Thoits, 2011). Sociological models predict that caring relationships can help individuals thrive through adversity by buffering the stressor (Feeney and Collins, 2015).

In this paper, we examine the relationship between the COVID-19 lockdowns and Google searches related to mental health in 11 Latin American countries. We include the following countries: Argentina, Bolivia, Chile, Colombia, Ecuador, Guatemala, Honduras, Mexico, Paraguay, Peru, and Uruguay. To evaluate the association between the timing of the lockdown and changes in mental health searches, we use an event-study design to assess search frequency of the following terms: insomnia, stress, anxiety, sadness, depression, and suicide. The analysis reveals whether searches for mental health-related terms increased during the COVID-19 lockdowns (as a proxy for current population mental health, Brodeur et al. (2020); Knipe et al. (2020)).

We also explore how changes in search patterns relate to policies implemented by the different governments of these 11 Latin American countries. Specifically, we test whether one particular policy tool — income support policies — can help mitigate searches related to adverse mental health conditions during the COVID-19 pandemic. To accomplish this, we exploit the date that each country passed income support legislation, and test whether such policies offered any benefit in terms of lower mental health-related Google searches. We also check for another potential mechanism for the association between the COVID-19 lockdowns and mental health-related searches, depending on the pandemic's intensity, measured by the COVID-19 death rate.

This study's findings are of particular importance as Latin America is one of the regions, along with Europe and North America, facing the biggest challenges in terms of health and economic crisis due to the COVID-19 pandemic. Compared to countries in Europe and North America, Latin American countries are underdeveloped, suggesting that the pandemic may have long-lasting repercussions. Accelerated deterioration of mental-health conditions could lead to costly consequences in terms of productivity and overall well-being.

**Literature Review.** This study adds to a body of work considering the relationship between the COVID-19 pandemic and mental health. Much of this work shows an association between the COVID-19 pandemic and deteriorations in mental health (Cao et al., 2020; Czeisler et al., 2020; Ettman et al., 2020; Lai et al., 2020; Liu et al., 2020; Nelson et al., 2020; Xiao et al., 2020). This deterioration in mental health during the pandemic may be due to a variety of factors including, stress, financial consequences, and isolation (Pfefferbaum and North, 2020).

Existing studies suggest adverse mental health consequences of the pandemic using survey data in a variety of settings. In the United States, Devaraj and Patel (2020) find that reduced mobility is associated with psychological distress. In China, Wang et al. (2020) document a moderate to severe deterioration in mental health during containment. In Japan, Yamamura and Tsutsui (2020) show evidence that the COVID-19 pandemic increased anxiety. In Canada, Carroll et al. (2020) suggest an increase in stress levels associated with financial instability.

Studies focusing on helpline calls also find worsening mental health in the initial phases of the pandemic (Armbruster and Klotzbucher, 2020; Brulhart and Lalive, 2020; Silverio-Murillo et al., 2021). In Switzerland, Brulhart and Lalive (2020) find that suicide calls increased during the initial phase of the lockdown, plateaued, and then returned to pre-pandemic levels. In Germany, Armbruster and Klotzbucher (2020) conclude that calls related to suicidal ideation increased after the lockdown, but flattened out in the following weeks. In Mexico, Silverio-Murillo et al. (2021) find an increase in anxiety-related calls, but no change in calls related to depression.

Two related studies also employ Google Trends in the United States and Europe. These studies track changes in search patterns as a proxy for population mental health. Knipe et al. (2020) employ Google Trends

data for Italy, Spain, USA, UK, and worldwide. Using data from January to March of 2020 and comparing before and after the lockdown, they find that Google-search levels for anxiety remained stable (except for Spain), while searches for depression showed mixed trends. Knipe et al. (2020) also observe an increase in searches for suicides during the first few weeks following the lockdown announcement. Brodeur et al. (2020) similarly consider Google Trends in Western Europe and the United States from January 1st to April 10th over 2019 and 2020. Results from their event study show an increase in search terms for sadness, worry, and loneliness. Despite the rise in searches for sadness, their findings indicate a decline in searches related to sleep problems, stress, and suicide.

Based on the existing evidence suggesting an association between adverse mental health outcomes and COVID-19 containment strategies, and on the stress process theory, which states that stressors like the pandemic can deteriorate mental health, we hypothesize that, in the short run, searches for mental health disorders in Latin America increases after the COVID-19 lockdowns. In addition, we hypothesize that income support policies help mitigate searches related to adverse mental health conditions during the COVID-19 pandemic. Finally, our third hypothesis suggests a positive relationship between searches for mental health disorders and the pandemic's intensity, measured by the COVID-19 death rate for each of the 11 Latin American countries analyzed in this study.

## 2. Method

**Google Trends Data.** We use Google Trends data to estimate the association between the COVID-19 lockdowns and mental health-related Google searches in Latin America. Google Trends provides an index on search terms ranging from zero to 100. Zero represents near-no searching activity, and 100 means high search activity. We rely on weekly data for the first 25 weeks of each year of investigation: 2016, 2017, 2018, 2019, and 2020. We collect the search trends for 11 Latin American countries included in this study: Argentina, Bolivia, Chile, Colombia, Ecuador, Guatemala, Honduras, Mexico, Paraguay, Peru, and Uruguay. We choose these countries following the criteria that they share the same language: Spanish. We exclude Venezuela due to suggestive evidence that some internet services are unavailable (Pérez Colomé, 2020). Throughout our analysis, we have no missing data; hence, every year contains 275 observations (11 countries times 25 weeks). In total, we have 1375 weeks (observations).

We follow trends for the following terms in Spanish: 1) "insomnia", 2) "stress", 3) "anxiety", 4) "sadness", 5) "depression" (we employ the Google Trends search option "depression - great" to avoid searches related to the comparison between the derived economic crisis in 2020 and the Great Depression in 1932), and 6) "suicide." All of these six words are rather common in Spanish-speaking countries. Moreover, the existing literature employs similar terminology (Brodeur et al., 2020; Knipe et al., 2020). Most importantly, all of these words have high search values, particularly when compared to simpler, equivalent Spanish words such as "awake", "pressured", "nervous", "unhappy", "discouraged", or "kill-myself."

**Mobility and Stay-at-home Orders.** In Latin America, as in the rest of the world, governments make use of stay-at-home orders as a tool to contain pandemics. At the time of analysis, all 11 countries in our study had a stay-at-home order at some point in time during the COVID-19 pandemic. In Paraguay, Uruguay, and Peru the stay-at-home order began on week 11 (March 9, 2020 to March 15, 2020). Argentina, Bolivia, Ecuador, Guatemala, and Honduras started their respective lockdowns on week 12 (March 16, 2020 to March 22, 2020). And, Chile, Colombia, and Mexico imposed stay-at-home orders on week 13 (March 23, 2020 to March 29, 2020). Mobility reductions, in practice, may occur before or after the recommendation or the official requirement.

Using mobility data from mobile applications provided by the United Nations Development Programme (UNDP) and the private company

GRANDATA, we detect when individuals begin to stay at home as the week where mobility on the week days is lower than on the immediate previous Sunday. We use this measure of lower weekday activity, as Sundays consistently have the lowest weekly mobility and acts as the primary weekend day for all 11 countries (per Catholic tradition). If individuals move less during the weekdays than in the immediate previous Sunday, this suggests a significant decrease in country-specific mobility. Applying this criterion, Paraguay begins a stay-at-home period on week 11 and the rest of the countries on week 12. In this study, we use the mobility data as the reference for the start of the stay-at-home; yet, in the robustness section, we use the official days of the quarantine and no changes occur across specifications. Throughout June of 2020 (the conclusion of our analysis), all Latin American countries remained on a national COVID-19 lockdown with the exceptions of Argentina, Bolivia, and Mexico. In the case of Argentina, lockdown restrictions eased on June 7, 2020, even though all urban areas, where the majority of Argentinians live, continued under strict lockdown orders. In the case of Bolivia and Mexico, both moved into a local alert system in June 2020, even though all local jurisdictions remain under medium or high stay-at-home order restrictions during that particular month.

**Income Support.** We then test whether the passage of income support has an association with mental health-related Google searches after the beginning of stay-at-home orders. We collect data on the date the income support legislation passed from Hale et al. (2020). These data indicate that the majority of Latin American countries did pass some level of income support, though the benefits were less generous than in the United States or Europe. The income support legislation appears in mid-March of 2020 for Peru and Uruguay (March 16, 2020 and March 18, 2020 respectively); at the end of March of 2020 for Argentina, Bolivia, and Paraguay (March 23, 2020; March 31, 2020, and March 31, 2020, respectively); and in April of 2020 for Ecuador, Chile, Honduras, Colombia, and Guatemala (April 1, 2020; April 2, 2020; April 3, 2020; April 7, 2020, and April 21, 2020, respectively). Mexico income support was practically nonexistent; Chile had two rounds of income support, with the first being less generous (passed April 2, 2020) than the second (June 16, 2020). For Chile, we focus on the date of the first round.

**COVID-19 Death rates.** We also examine whether the intensity of the pandemic, calculated by the COVID-19 death rate in each of the analyzed countries, affects mental health-related Google searches. We employ data from the COVID-19 Data Repository by the Center for Systems Science and Engineering (CSSE) at Johns Hopkins University, with a cutoff date of June 21, 2020 (the 25th week of 2020 in our analysis). The range in the intensity of the pandemic across the region is large, providing enough variation to test heterogeneous relationships.

**Summary Statistics.** Table 1 displays the descriptive statistics for Google searches related to insomnia, anxiety, sadness, stress, depression, and suicide. The summary statistics contain information for the 11 countries, for 2016, 2017, 2018, 2019, and 2020, over the first 25 weeks of each investigation year. The table indicates that the anxiety searches are the highest occurrence searches, sadness searches next, and then depression searches, insomnia searches, and stress searches. Suicide searches occur less frequently. The year 2020 stands out as substantially

higher for searches related to insomnia, stress, anxiety, and depression. Suicide and sadness searches are more similar across 2020 and previous years.

**Modeling.** To estimate the association between the COVID-19 lockdowns and mental health-related Google searches, we use a weekly event-study specification. Formally, this specification appears as:

$$Y_{cty} = \sum_{w=-11}^{11} \beta_w Covid_{ctwy} + a_c + \gamma_t + \nu_y + e_{cty} \tag{1}$$

where  $Y_{cty}$  is the outcome of interest for country  $c$  in week  $t$  and year  $y$ .  $Covid_{ctwy}$  is a set of dummy variables that take the value of one before and after starting the lockdown in each country. The week the lockdown begins is represented by week zero,  $w = 0$ . The week before the lockdown,  $w = -1$ , acts as the excluded period. This week just before the lockdown acts as the baseline period and includes all of 2016 through 2019. Thus, the main effect is relative to both (1) the same weeks during prior years, and (2) the week just before the beginning of the lockdown. The full event study considers 11 periods before and 11 periods after the lockdown begins. Observations more than 11 weeks after the lockdown are grouped with week 11.  $a_c$  are country-fixed effects, which control for time-invariant differences across countries.  $\gamma_t$  are weekly fixed-effects and controls for potential seasonal effects.  $\nu_y$  are year-fixed effects, which control for annual changes in mental health-related searches. To correct for autocorrelation of the outcome—measured across weeks within countries—we apply clustered standard errors at the country level. The coefficients of interest are the  $\beta_w$ .

The event study allows us to infer causality by assuming temporal stability and independence (exogeneity) on the imposition of stay-at-home orders throughout different Latin American countries (Holland, 1986). This flexible event-study strategy isolates the effect of the COVID-19 lockdowns on mental health searches as long as there are no concurrent events that correlate with the timing of each country's stay-at-home order. However, given the observational nature of our study, we can not corroborate these assumptions; hence, we leave our conclusion at the association level.

### 3. Results

#### 3.1. Event-study results

Fig. 1 and Table A1 show the results for the event-study specification across the six outcomes of interest. The first graph of Fig. 1 depicts the findings over insomnia searches. We find a clear increase in the level of insomnia searches, immediately after the beginning of the lockdown. This increase of insomnia searches fades as the weeks in lockdown elapse. However, the null association only occurs after the 10th week into the COVID-19 lockdown.

Next, we show stress searches in the second graph of Fig. 1 (Column 2 in Table A1). The results show an increase in stress searches, with the majority of the plotted points showing a statistically significant

**Table 1**  
Descriptive statistics.

	2020		2019		2018		2017		2016		All	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Insomnia	52.5	22.3	36.8	15.5	36.6	16.7	34.0	15.2	32.2	15.3	38.4	18.7
Stress	52.3	22.4	35.3	16.4	27.3	13.6	24.0	13.9	24.1	14.6	32.6	19.6
Anxiety	71.3	17.6	48.3	13.8	40.8	12.8	37.4	12.5	32.8	11.6	46.1	19.3
Sadness	36.5	14.5	39.6	14.8	43.6	15.7	48.9	17.5	53.7	19.8	44.5	17.7
Depression	57.4	22.3	45.6	17.7	32.0	14.1	30.5	14.8	28.7	14.1	38.8	20.2
Suicide	21.2	11.8	28.7	19.9	23.6	15.5	23.0	12.9	23.2	14.7	24.0	15.4
Observations	275		275		275		275		275		1375	

SOURCE: Google Trends. The data includes 11 Latin American countries for the years 2016–2020, including weeks 1–25 of each year.

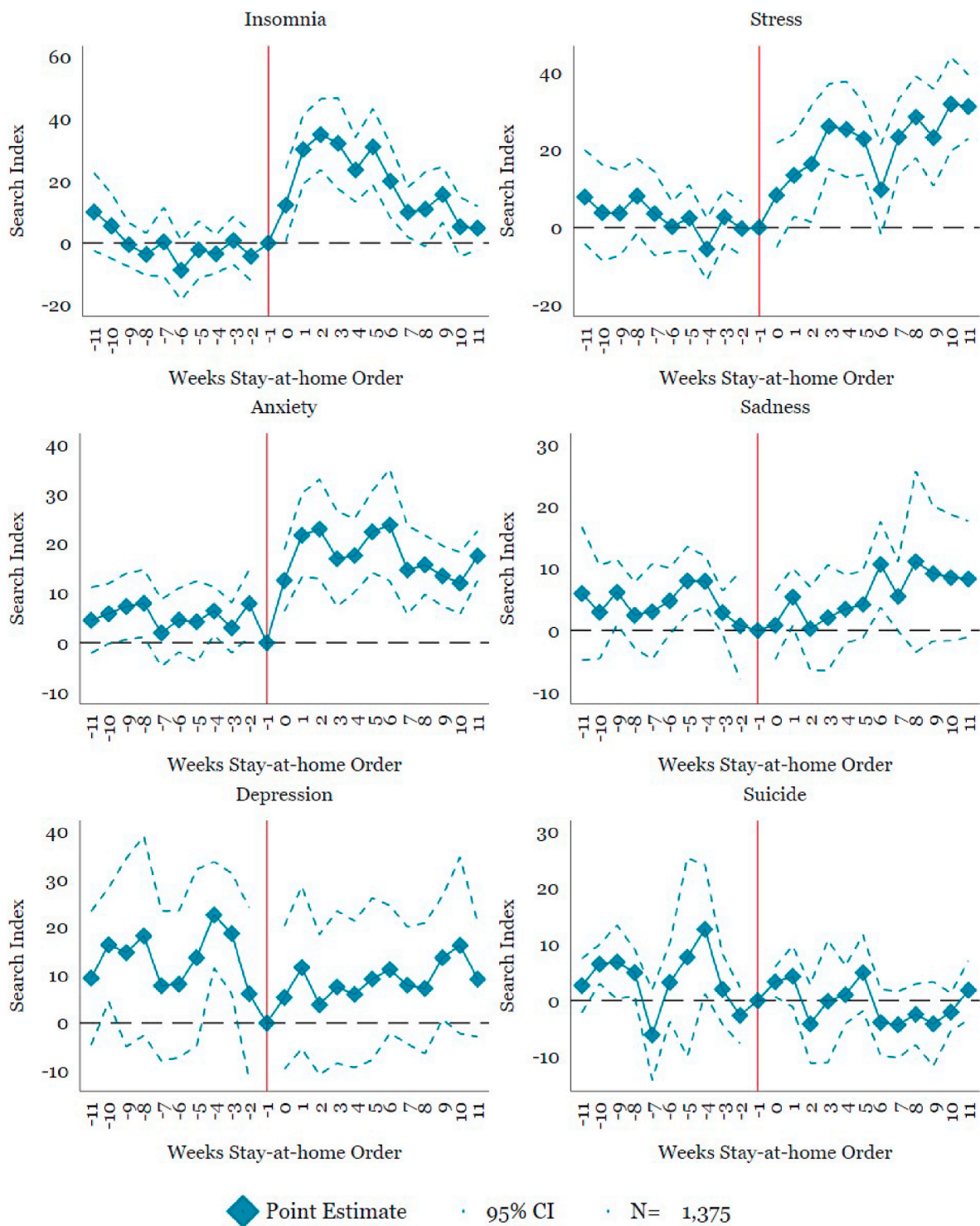


Fig. 1. Event study: Main findings.

SOURCE: Google Trends. The data includes 11 Latin American countries for the years 2016–2020, including weeks 1–25 of each year. NOTES: Plotted coefficients are event-study dummy variables,  $\beta_w$ . Each plotted point represents the number of weeks before and after the lockdown, excluding the period just before adoption. Solid lines represent point estimates. Dashed and dotted lines display the 95 percent confidence intervals. Baseline fixed effects are included at the country, week, and year. Robust standard errors are clustered at the country level.

coefficient after the lockdown. Similarly, anxiety searches sharply increase in week one and continues to rise in week two as depicted in the third graph of Fig. 1 (Column 3 in Table A1). Searches for anxiety continue above the baseline level for the remainder of the 11 post-period weeks. The fourth graph of Fig. 1 displays the association between the COVID-19 lockdown and searches for sadness (Column 4 in Table A1).

We also observe an increase in searches for sadness, but it reaches statistical significance only for weeks one and six.

The fifth graph of Fig. 1 displays the relationship between stay-at-home orders and depression searches (Column 5 in Table A1). We observe no change in depression-related searches and these appear to be higher before the COVID-19 stay-at-home order. By the same token, the

sixth graph of Fig. 1 shows the association between the COVID-19 lockdown and suicide searches (Column 6 in Table A1). In the weeks leading up to the stay-at-home order, the plotted points hover around zero, except for the first week. Yet, the pattern resembles very much to depression searches over the lockdown period.

To conclude the main results, we also include a difference-in-differences approach as an alternative to the main event study. We choose an event study as our main specification for two reasons. First, the event study captures the fact that association magnitudes vary from week-to-week. This time-varying relationship is not captured by a difference-in-difference methodology (Goodman-Bacon, 2018; Wolfers, 2006). Second, we see a benefit in considering the periods leading up to the stay-at-home order to analyze pre-trends. Without these periods, we do not know whether the mental health-related searches change before the COVID-19 pandemic.

Despite these limitations with a difference-in-difference approach, it still may be helpful to see whether this specification affects our findings' interpretation. We show the difference-in-difference specification in Table 2 (Panel A). The results in the difference-in-difference strategy suggest similar conclusions to the main event study. Searches for insomnia, stress, and anxiety, all increase in the weeks following the

stay-at-home order. Conversely, there is no statistically significant association between the COVID-19 lockdowns and sadness-related searches, depression-related searches or suicide-related searches.

### 3.2. Potential mechanisms

**Income support legislation.** To test whether income support moderates the mental health-related searches during the COVID-19 stay-at-home orders, we include a second set of differences-in-differences results, where we interact the baseline associations with a binary variable that equals one beginning the week that each country passed income support legislation. We use the exact week that the income support legislation passed, which varies by country. Table 3 (Panel A) shows these results. The estimates suggest that while there is no relation across levels of searches for anxiety or stress, the passage of income support legislation is associated with lower insomnia and suicide searches. Despite this beneficial association, however, Table 3 shows that searches for sadness are higher in countries that passed income support. Overall, the findings suggest that income benefits cannot be associated with a reduction in all types of mental health-related searches.

**COVID-19 intensity.** We also test whether the pandemic intensity,

**Table 2**  
Alternative specifications.

Panel A: Difference-in-differences						
	Insomnia	Stress	Anxiety	Sadness	Depression	Suicide
	(1)	(2)	(3)	(4)	(5)	(6)
1(Post × COVID-19)	18.06*** (2.48)	20.96*** (2.48)	12.88*** (2.36)	2.36 (2.08)	-2.99 (2.58)	-3.61 (2.41)
Observations	1375	1375	1375	1375	1375	1375
Adjusted R-squared	0.57	0.49	0.82	0.73	0.55	0.40
Mean Dependent	38.43	32.58	46.12	44.47	38.84	23.98
Baseline FE	X	X	X	X	X	X
Time Trend	X	X	X	X	X	X
Panel B: Grouped Pre-Period						
	Insomnia	Stress	Anxiety	Sadness	Depression	Suicide
	(1)	(2)	(3)	(4)	(5)	(6)
Week 0	12.93* (6.09)	6.09 (6.22)	7.80** (3.01)	-3.08 (2.75)	-6.66 (4.85)	-0.06 (1.57)
Week 1	30.93*** (5.27)	11.17** (4.98)	16.79*** (4.62)	1.39 (2.68)	-0.62 (5.03)	0.86 (3.27)
Week 2	35.73*** (6.03)	14.08** (5.64)	18.06** (5.89)	-3.72 (3.14)	-8.44* (3.85)	-7.60** (3.30)
Week 3	32.86*** (6.67)	23.80*** (4.73)	12.04** (5.28)	-1.97 (2.77)	-4.69 (5.89)	-3.56 (5.66)
Week 4	24.31*** (4.33)	23.02*** (6.96)	12.71*** (3.71)	-0.57 (1.20)	-6.26 (4.76)	-2.43 (2.83)
Week 5	31.76*** (5.97)	20.62*** (5.44)	17.46*** (4.02)	0.17 (3.03)	-3.03 (4.11)	1.51 (4.39)
Week 6	20.67*** (5.28)	7.50 (5.53)	18.87*** (5.61)	6.64** (2.77)	-1.04 (4.04)	-7.31** (2.94)
Week 7	10.63** (4.09)	21.04*** (5.35)	9.77* (5.07)	1.47 (2.09)	-4.32 (4.62)	-7.75*** (2.36)
Week 8	11.62** (4.88)	26.21*** (5.44)	10.83*** (3.15)	7.09 (7.06)	-5.01 (4.80)	-5.91** (2.55)
Week 9	16.32** (5.17)	20.92** (6.61)	8.60** (3.05)	5.14 (5.04)	1.41 (4.68)	-7.60* (4.12)
Week 10	5.98 (4.20)	29.55*** (5.11)	7.13 (4.07)	4.50 (3.97)	4.01 (7.45)	-5.50** (2.28)
Week 11	5.82 (3.34)	29.20*** (4.58)	12.67*** (3.44)	4.43 (3.70)	-2.64 (3.78)	-1.67 (3.20)
Observations	1375	1375	1375	1375	1375	1375
Adjusted R-squared	0.60	0.50	0.82	0.73	0.54	0.40
Mean Dependent	38.43	32.58	46.12	44.47	38.84	23.98
Baseline FE	X	X	X	X	X	X
Time Trend	X	X	X	X	X	X

NOTES: Panel A shows the difference-in-differences estimates, which group the pre-period and post periods. Panel B shows a grouped pre period. Baseline fixed effects are included at the country, week, and year. Robust standard errors are clustered at the country level. Significance levels: \* $p < 0.1$ , \*\* $p < 0.05$ , \*\*\* $p < 0.01$ . SOURCE: Google Trends. The data includes 11 Latin American countries for the years 2016–2020, including weeks 1–25 of each year.

**Table 3**  
Heterogeneous effects.

Panel A: Subsequent Passage of Income Support						
	Insomnia	Stress	Anxiety	Sadness	Depression	Suicide
	(1)	(2)	(3)	(4)	(5)	(6)
1(Post × COVID-19)	28.05*** (3.39)	19.52*** (5.30)	15.90*** (2.36)	-1.24 (1.80)	-0.87 (3.73)	-0.97 (2.83)
1(Post × COVID-19 × Income Support)	-13.86*** (3.12)	2.00 (6.22)	-4.20 (2.48)	4.99** (2.23)	-2.94 (3.25)	-3.67* (1.94)
Observations	1375	1375	1375	1375	1375	1375
Adjusted R-squared	0.58	0.49	0.82	0.73	0.55	0.40
Mean Dependent	38.43	32.58	46.12	44.47	38.84	23.98
Baseline FE	X	X	X	X	X	X
Time Trend	X	X	X	X	X	X
Panel B: Death Rate Higher than 100 Deaths Per Million						
	Insomnia	Stress	Anxiety	Sadness	Depression	Suicide
	(1)	(2)	(3)	(4)	(5)	(6)
1(Post × COVID-19)	13.89*** (2.42)	16.76*** (3.03)	10.00** (3.23)	-0.16 (1.95)	-3.62 (2.67)	-2.37 (2.85)
1(Post × COVID-19 × High Death Rate)	11.48*** (2.88)	11.56*** (3.52)	7.92* (4.18)	6.91 (3.82)	1.72 (4.70)	-3.41 (3.61)
Observations	1375	1375	1375	1375	1375	1375
Adjusted R-squared	0.57	0.50	0.82	0.73	0.55	0.40
Mean Dependent	38.43	32.58	46.12	44.47	38.84	23.98
Baseline FE	X	X	X	X	X	X
Time Trend	X	X	X	X	X	X

NOTES: A high death rate indicates having a death rate of more than 100 deaths per million. Baseline fixed effects are included at the country, week, and year. Robust standard errors are clustered at the country level. Significance levels: \* $p < 0.1$ , \*\* $p < 0.05$ , \*\*\* $p < 0.01$ .

SOURCE: Google Trends. The data includes 11 Latin American countries for the years 2016–2020, including weeks 1–25 of each year.

based on the COVID-19 death rate, affects our findings. The death rate in our sample ranges from 1.8 per million inhabitants in Paraguay to 238.4 in Peru until June 21, 2020 (Rosier and Ortiz-Ospina, 2020). The death rates per million in the rest of the countries are as follows: Ecuador (237.9), Chile (224.6), Mexico (161.1), Bolivia (63.3), Colombia (41.7), Honduras (36.1), Guatemala (28.6), Argentina (21.9), and Uruguay (7.2). In Table 3 (Panel B), we show interactions between the post-COVID indicator with an indicator for a high death rate (more than 100 deaths per million). A high death rate implies an intense initial level of pandemic in a given country. For insomnia searches, stress searches, and anxiety searches, the results show a magnified association in countries that suffered a high initial pandemic intensity. In all, these findings suggest that the pandemic’s intensity is related to mental health-related Google searches.

### 3.3. Robustness checks

To test the robustness of our findings, we use several alternative specifications. First, we show the results using a grouped pre-period. Second, we use a wild-cluster bootstrap procedure. Third, we exclude one country at a time from the analysis. Fourth, we add population weights. Fifth, we include country-specific time trends. Sixth, we use the official dates of the stay-at-home order. Seventh, we implement a placebo test. Finally, we compare administrative data to the Google Trends findings. All tests verify the conclusions from the main specification.

To allow for more flexibility than our difference-in-difference estimates permit, and yet still more rigid than in our event-study calculations, our first alternative specification shows a middle-ground estimation by applying an event-study design with a grouped pre-period and a time trend in Table 2 (Panel B). The findings here are similar to the main results and the difference-in-differences findings (see Panel A). Second, to test for possible biases in our estimations of standard errors, we show wild cluster standard errors. Cameron et al. (2008) suggest that standard errors are downward-biased with a low number of clusters (five to 30). Given that we have 11 clusters at the country level, we conduct a wild cluster bootstrap procedure, as described in Cameron et al. (2008).

Table A2 reproduces the results of Table A1 using a wild cluster boot-strap procedure to calculate standard errors. Under this method, Table A2 shows that all coefficients remain statistically significant.

Our third robustness check excludes one country at a time from the analysis. We find evidence that Google searches for insomnia, stress, anxiety, and sadness increase after the COVID-19 lockdowns. However, the results may be a consequence of an outlier or a single country-level policy change. Excluding one country at a time checks whether these alternatives are plausible. We reproduce the event-study, excluding one country at a time, in Figures A.1 and A.2. Throughout Figures A1 and A.2, the coefficients remain statistically significant. For this check, we do not present the results for depression or suicide searches as these remain statistically equal to zero (these results are available upon a request to us).

In our fourth and fifth robustness checks, we add weights for the country’s population size and country-specific weekly time trends. These checks allow us to give more importance to larger countries, for the case of adding weights, and to control for country-specific linear tendencies in mental health-related searches, for the case of adding time trends. Figure A.3 shows each of these robustness checks, with the weighted calculations in dark-blue diamonds and the time trends in light-blue triangles. The plotted points appear similar to each other as well as to the main results in Fig. 1. Adjusting the main specification by adding weights and weekly time trends has little impact on the interpretation of the findings.

Fifth, we conduct a robustness check using the stay-at-home order’s official announcement date instead of the observed reduction in mobility. This robustness check deals with any concerns over our interpretation of the lockdown as a decrease in mobility. We replace these *de facto* (observed) dates with the precise *de jure* lockdown dates for each country. The alternative results are presented in Figure A.4, and reflect the main findings using the observed dates. This robustness test confirms that the findings are similar across *de facto* observed and *de jure* legal dates.

Sixth, Figure A.5 presents results using a placebo test; this test checks for seasonality in the data and tests the relationship as if the stay-at-

home orders had occurred in 2019. To do so, we remove 2020 from the data and consider the years 2016–2018 in the excluded period. Figure A.5 shows the expected null results for the same period in 2019. The results confirm that the mechanics of the specification are not producing the main results. We interpret the lack of association in 2019 as ensuring that seasonality is not producing the main findings in 2020.

As a final check, we compare results from Google Trends with administrative data. One potential concern of the Google Trends data is that the searches may not be associated with the users' current feelings and behaviors, or that internet access may bias our results. We do not have administrative data from Latin America. Yet, we have administrative data for helpline services in Mexico City, including information for calls related to anxiety and depression. Thus, we compare the helpline services' administrative data and Google Trends in Mexico City. The results are presented in Figure A.6. We observe a similar pattern in the administrative data and the Google Trends, where anxiety rises sharply, but depression is relatively constant.

Overall, these additional checks bolster confidence in the main findings—that mental health-related searches increased during the pandemic. Our results consistently show that searches for anxiety, stress, sadness, and insomnia increased throughout Latin America during the start of the pandemic. While we cannot determine with certainty whether the pandemic or the lockdowns *caused* the change in search patterns, the increase in search volume is related to the timing of both the lockdowns and the pandemic itself. Yet, our empirical strategy still may be polluted by a third factor, correlated with the timing of the COVID-19 pandemic and lockdown. This outside (unobserved) factor may be the causal mechanism for the change in search patterns. Still, this unobserved change must be perfectly correlated with the timing of the initial lockdowns to produce the patterns observed in the data. Therefore, we view the worldwide pandemic and the stay-at-home orders as the most likely cause of the change in search patterns during the period studied.

#### 4. Discussion

The findings from this study make several contributions to the mental health and COVID-19 pandemic literature. First, we reach similar conclusions to those in the existing body of literature analyzing the association between the COVID-19 lockdowns and mental health-related Google searches. For instance, we show an increase in anxiety searches, which coincides with the findings in Knipe et al. (2020) for Italy, Spain, USA, UK, and worldwide. Similarly, the increase in searches for sadness matches the results of Brodeur et al. (2020) for Western Europe and the United States. Nevertheless, we also find contradicting results with this existing literature. Namely, Brodeur et al. (2020) find no repercussions on searches for sleeplessness and insomnia in the United States, while we observe a clear jump in insomnia searches in Latin America. We also show an increase in stress-related searches following the lockdowns in Latin America, while Brodeur et al. (2020) finds a decrease in stress-related searches after the stay-at-home orders in Western Europe and the United States.

One possible explanation for these differences in results is that Brodeur et al. (2020) analyzes the relationship for only three weeks after the COVID-19 lockdown, while our analysis spans to 11 weeks of the stay-at-home order. Another explanation is the difference between the two contexts. We point to considerable variation in income support across the regions. Uncertainty over income has the potential to increase insomnia searches and stress searches. Our suggested mechanisms shows a substantial decrease in the association size for insomnia searches after the passage of income support policies in Latin America, even though this support was relatively small. Our potential mechanisms also point to the fact that the association levels between lockdowns and insomnia searches or stress searches are larger in countries with a high intensity of the pandemic. Further, lower health capacities in Latin American countries, in comparison to Western European countries

and the United States, may also drive the difference in results for insomnia searches and stress searches. Together, this may mean that the health capacity of seriously hit Latin American countries saturates more rapidly, provided the poor health infrastructure in this region of the world.

Second, our conclusions corroborate two related studies using call center data to proxy for mental health outcomes (Armbruster and Klotzbucher, 2020; Brulhart and Lalive, 2020). In particular, we find evidence for a positive relation between stay-at-home orders and anxiety searches, which matches the results of Armbruster and Klotzbucher (2020) and Brulhart and Lalive (2020), who use helpline calls for Germany and Switzerland, respectively, and also find increasing concerns for anxiety among callers. Further, results from Armbruster and Klotzbucher (2020) and Brulhart and Lalive (2020) point to an increase in calls about suicide, which then flattens out. This evidence resembles our conclusion for the trajectory of suicide searches in Latin America during the first week after the lockdown, which then disappears. Third, the current results also relate to studies employing survey data to measure mental wellbeing (Carroll et al., 2020; Devaraj and Patel, 2020; Wang et al., 2020; Yamamura and Tsutsui, 2020). These studies find increases in psychological distress (Devaraj and Patel, 2020) and stress, anxiety, and depression (Carroll et al., 2020; Wang et al., 2020; Yamamura and Tsutsui, 2020). The findings from these studies corroborate the positive association between stress and anxiety searches with the timing of the COVID-19 lockdown.

Finally, the results in this paper support the stress process theory's hypothesis. This theory indicates that pandemics, which can be considered as a stressor, deteriorates mental health outcomes (Thoits, 2010). More importantly, actual and perceived isolation, through the imposition of stay-at-home orders, accelerates the detrimental pattern in mental well-being (Holt-Lunstad et al., 2015). However, this detriment seems modest for Latin American countries. The null association of the COVID-19 lockdown and depression searches might be driven by the fact that very few people in certain countries in Latin America consider depression a serious health problem. For instance, in Mexico, the percentage of depressed adults without a medical diagnosis is over 75% (Belló, 2005). Stress process theory provides another possible explanation, that extended time with family or other meaningful social relationships may be buffering the relationship between the COVID-19 lockdown and psychological well-being (Thoits, 2011).

**Limitations.** There are two limitations in this study. First, we cannot verify that search indicators are accurately related to the users' current feelings and behaviors. Second, internet users may not be representative of the population in this region. Given the impossibility of conducting face-to-face surveys during the pandemic, our results using Google Trends can help discern the association of the COVID-19 pandemic and mental health.

Further research for Latin America should try to overcome the limitations in this study by including accurate indicators for feelings and behaviors during the pandemic and a representative sample for all or part of the region. Future research studying the association of mental health outcomes and the COVID-19 pandemic should also consider collecting information on whether caring relationships act as a buffer for the stressor damage. Indeed, by deepening our understanding of this matter, policymakers in Latin America can more efficiently alleviate mental health problems arising from this extraordinary event.

#### 5. Conclusions

This paper analyzes the association between COVID-19 lockdowns and searches for insomnia, stress, anxiety, sadness, depression, and suicide using Google trends across Latin America. Our findings indicate that Google searches for insomnia sharply increased and then declined to baseline, ten weeks into the lockdown. We also observe an increase in searches related to anxiety, and stress, remaining high throughout the lockdown. Conversely, we find no change in depression-related or



suicide-related searches after the stay-at-home orders in Latin America.

We conclude by exploring potential mechanisms by which the stressor affects search patterns. We test two potential channels, income support, and pandemic intensity. In terms of income support legislation, our results suggest that searches declined for suicide and insomnia following the passage of each country's income support. Concerning the intensity of the pandemic, in countries with higher COVID-19-related death rates, searches for insomnia, stress, and anxiety increased more. Some of our findings suggest that both intensity of the pandemic and income support are related to mental health search patterns.

#### Credit author statement

**Lauren Hoehn-Velasco:** Conceptualization, Methodology, Writing – review & editing. **Adan Silverio-Murillo:** Writing – original draft, Data curation, Methodology, Writing – review & editing. **Jose Roberto Balmori de la Miyar:** Investigation, Writing – review & editing. **Abel Rodríguez Tirado:** Conceptualization, Data curation, Writing – review & editing.

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#### Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.socscimed.2021.114040>.

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