Journal of Public Health | pp. 1–8 | doi:10.1093/pubmed/fdaa148

COVID-19 restrictions and mental distress among American adults: evidence from Corona Impact Survey (W1 and W2)

Harris Hyun-Soo Kim[1], James Laurence[2,3]

[1]Department of Sociology, Ewha Womans University, Seoul, 03760, Republic of Korea
[2]Cathie Marsh Institute for Social Research, University of Manchester Oxford Road, Manchester, M13 9PL, UK
[3]Wissenschaftszentrum Berlin für Sozialforschung WZB Berlin Social Science Center, D-10785 Berlin, Germany
Address correspondence to Harris Hyun-Soo Kim, E-mail: harrishkim@ewha.ac.kr

ABSTRACT

Background The present study examines the impact of coronavirus-related restrictions on mental health among American adults, and how this relationship varies as a function of time and two measures of vulnerability (preexisting physical symptoms and job insecurity).
Methods We draw on data from two waves of Corona Impact Survey, which were fielded in late April and early of May 2020. Multilevel models were used to analyze the hierarchically nested data.
Results Experiencing coronavirus disease-2019 restrictions significantly raise mental distress. This association is stronger for individuals with preexisting health conditions and those who worry about job prospects. These findings hold with the inclusion of region-wave covariates (number of deaths, wave dummy and aggregate measure of restrictions). Finally, there is a cross-level interaction: the restriction-distress connection is more pronounced in the second wave of data.
Conclusions Our research indicates that people who are more physically and/or financially vulnerable suffer more from the imposed restrictions, i.e. 'social isolation'. The mental health impact of coronavirus pandemic is not constant but conditional on the level of vulnerability.

Keywords COVID-19, financial insecurity, mental distress, physical vulnerability, social isolation

Introduction

In the wake of the coronavirus disease-2019 (COVID-19) pandemic, people have suffered globally from deteriorating mental, in addition to physical, health as they are forced to undergo limited mobility, if not total lockdown, and become subject to uncertainties, loneliness and social isolation.[1–6] In the USA, which accounts for almost a quarter of all coronavirus-related deaths in the world,[7] signs of the harmful mental and psychological consequences of COVID-19 are clear. According to the Household Pulse Survey, 30% of American adults showed symptoms of anxiety and 24% reported depressive symptoms,[8] a sharp increase from the National Health Interview Survey results (9.2% for anxiety and 6.6% for depression) collected from January to June 2019 prior to the onset of the pandemic. Restrictions and resulting social isolation due to the coronavirus disease have not affected individuals equally, however.[9–11] Media, international organizations and academia all suggest that the impact of COVID-19 has been felt disproportionately, with the socially marginalized or vulnerable bearing the brunt of it in terms of job and savings losses.[12–17] The possibility of existing inequality (vulnerability) magnifying the consequences of COVID-19, therefore, looms large.

In this study, using data on representative samples of US respondents, we test this possibility. Specifically, we investigate whether the association between coronavirus-induced restrictions and feelings of distress is more pronounced among individuals in an objectively and/or a subjectively vulnerable condition: people with preexisting health conditions and/or those who feel insecure about their job prospects, respectively. We first conjecture that preexisting symptoms (objective vulnerability) and job insecurity (subjective vulnerability) are related to mental

Harris Hyun-Soo Kim, Professor of Sociology
James Laurence, Research Fellow

distress independently of coronavirus-related restrictions or social isolation. We further hypothesize that the negative effects of imposed restrictions would be greater for the two vulnerable groups. Additionally, we check whether the impact varies temporally. Based on multilevel modeling (individuals nested in region-wave units), we find significance evidence in support of our hypotheses, as well as limited support for the increasing trend effect. The present study is the first to empirically demonstrate the contingent impact of COVID-19 on mental health over time and across two distinct moderators operationalized in terms of objective (physical) and subjective (financial) vulnerability. Our empirical analysis is informed by the following hypotheses and research question:

Hypothesis 1 (**H1**): The impact of coronavirus-related restrictions on mental distress is worse for the physically vulnerable.

Hypothesis 2 (**H2**): The impact of coronavirus-related restrictions on mental distress is worse for the financially vulnerable.

Research Question (**RQ**): Has the impact of coronavirus-related restrictions on mental distress increased/decreased over time?

Methods

Data source

Data are drawn from two waves (W1 and W2) of the COVID-19 Household Impact Survey ('Corona Impact Survey'), which were fielded in late April (20–26) and early May (4–10) of 2020, respectively. It is funded by the Data Foundation (https://www.datafoundation.org/), and the survey was conducted by NORC at the University of Chicago. Corona Impact Survey is designed to provide estimates of the US adult household population nationwide and for 18 regional areas including 10 states (California, Colorado, Florida, Louisiana, Minnesota, Missouri, Montana, New York, Oregon and Texas) and 8 Metropolitan Statistical Areas (Atlanta, Baltimore, Birmingham, Chicago, Cleveland, Columbus, Phoenix and Pittsburgh). The sampling frame is based on an extract of the USA. Postal Service delivery-sequence file provides sample coverage of ∼97% of the US household population. We combine subsamples from the regions across W1 (N = 7467) and W2 (N = 7420). After listwise deletion of cases with missing data, the effective sample size (for the fully specified pooled model) is 12 825 observations nested in 36 (18 × 2) region-wave units. Technical details on the sampling procedures are available at the website maintained by the Data Foundation (https://www.covid-impact.org/results).

Variables

The outcome measure is 'Mental distress' operationalized using answers to a battery of questions concerning feelings of distress related to COVID-19 during the past week ('Felt nervous, anxious, or on edge', 'Felt depressed', 'Felt lonely', etc.). Answers are originally coded on a four-point scale. For dimension reduction, we used principal component analysis to produce a single latent factor (Bartlett's test of sphericity $P < 0.001$; Kaiser–Meyer–Olkin test = 0.85; Cronbach's alpha = 0.82). The main predictor is 'COVID restrictions', a frequency measure related to the following question: 'In the past 7 days, have your personal plans been changed or affected by the following types of restrictions, or not?' Respondents answered this question with respect to 19 government-imposed lockdown measures (see Table 1 for detail).

There are two moderators for hypothesis testing: 'Pre-existing conditions' (for **H1**) and 'Job insecurity' (for **H2**). The former is based on the survey item inquiring about prior diagnoses concerning a number (frequency measure) of physical illnesses. The latter is measured based on a question asking respondents about their likelihood of being employed in the next month. Our models adjust for the following confounders at the individual level: age, gender (female = 1), race (white = 1), education (using two nominal categories), family size (total number of people in the household), annual income (coded on a nine-point scale), employment status (worked last week = 1) and place of residence (urban = 1). At the contextual (region-wave) level, we control for 'Regional lockdown' (an aggregate version of 'COVID restrictions' created by averaging individual answers across the region-wave units), a dummy indicator for time (W2) and 'Infected cases', an official count of the (logged) number of coronavirus infections. Descriptive statistics, along with variable definitions and coding criteria, are provided in Table 1.

Analytic approach

We fitted a series of random intercept and random slope mixed-effects models using the statistical software HLM version 8,[18] results of which are summarized in Tables 2 and 3. In the empirical analysis, level-1 units are the individual respondents and level-2 comprises the region-wave units. Cases are adjusted using individual weights to make them representative of the regions from which they had been drawn. Table 2 contains random intercept models to test **H1** and **H2**. As robustness checks, Table 3 replicates these findings by adding level-2 (region-wave) covariates; random slope models are also estimated to address the **RQ**.

Table 1 Descriptive statistics, variable definitions and coding details

	Mean/proportion	SD	Min	Max
Outcome measure				
Mental distress:	0	1	−0.79	4.12
In the past 7 days, how often have you . . . A. Felt nervous, anxious, or on edge; B. Felt depressed; C. Felt lonely; D. Felt hopeless about the future; E. [ANCHOR] Had physical reactions such as sweating, trouble breathing, nausea or a pounding heart when thinking about your experience with the coronavirus pandemic (1 = not at all or <1 day, 2 = 1–2 days, 3 = 3–4 days, 4 = 5–7 days).				
Individual level covariates: **COVID restrictions:**	7.38	4.32	0	19
In the past 7 days, have your personal plans been changed or affected by the following types of restrictions, or not? A. K-12 school closure B. Pre-K or child care closure C. College or training closure D. Ban on gatherings of 250 people or more E. Ban on gatherings of 50 people or more F. Ban on gatherings of 10 people or more G. Closure of place of worship H. Reduced public transportation I. Other reduced public services J. Closure of bars K. Closure of restaurants L. Closure of gyms or fitness facilities M. Closure of other businesses N. Canceled sport events O. Closure of work P. Work from home requirements Q. Quarantine requirements or stay-at-home orders R. International travel restrictions or bans S. Domestic travel restrictions or bans (1 = yes; 0 otherwise)				
Preexisting conditions:	1.92	1.68	0	12
Has a doctor or other health care provider ever told you that you have any of the following? A. Diabetes B. High blood pressure or hypertension C. Heart disease, heart attack or stroke D. Asthma E. Chronic lung disease and chronic obstructive pulmonary disease F. Bronchitis and emphysema G. Allergies H. A mental health condition I. Cystic fibrosis J. Liver disease or end stage liver disease K. Cancer L. A compromised immune system M. Overweight or obesity (yes = 1; 0 otherwise)				
Job insecurity:	2.9	1.68	1	5
Think ∼30 days from now, how likely do you think it is that you will be employed at that time? (1 = extremely likely, 2 = very likely, 3 = Moderately likely, 4 = not too likely, 5 = not likely at all)				
Age (1 = 18–24, 2 = 25–34, 3 = 35–44, . . . 6 = 65–74, 7 = 75+)	4.27	1.74	1	7
Female	57%		0	1
White	75%	__	0	1
BA and above	56%	__	0	1
Some college	29%	__	0	1
Family size (1 = one person, I live by myself, 2 = two persons, 3 = three persons, . . . 6 = six or more persons)	2.33	__	1	6
Household income (1 = <$10 000, 2 = $10 000–$20 000, 3 = $20 000–$30 000, . . . 7 = $75 000–$100 000, 8 = $100 000–$150 000, 9 = $150 000+)	5.86	1.31	1	9
Worked (Ref.: not employed)	50%	2.36	0	1
Urban (Ref.: suburban and rural)	81%	__	0	1
(Region-wave level covariates) W2	50%	__	0	1
Regional lockdown:	7.39	0.55	5.59	8.34
Infected cases (ln) (Source: COVID-19 Data Repository by the Center for Systems Science and Engineering at Johns Hopkins University)	9.66	1.37	6.09	12.7

COVID Impact Survey (W1 and W2).

Table 2 Random intercept models predicting 'Mental distress' (level-1 variables only)

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
	Coef.	(SE)	Coef.	(SE)	Coef.	(SE)	Coef.	(SE)	Coef.	(SE)	Coef.	(SE)
Individual level												
COVID restrictions			0.035***	(0.004)	0.038***	(0.004)	0.027***	(0.004)	0.013*	(0.006)	0.012	(0.007)
Preexisting conditions					0.122***	(0.010)	0.156***	(0.010)	0.086***	(0.018)	0.156***	(0.010)
Job insecurity					0.023*	(0.010)	0.087***	(0.014)	0.088***	(0.014)	0.047*	(0.021)
Age							−0.222***	(0.011)	−0.221***	(0.011)	−0.221***	(0.011)
Female							0.138***	(0.031)	0.141***	(0.031)	0.138***	(0.031)
White							0.213***	(0.034)	0.211***	(0.034)	0.214***	(0.034)
BA and above							−0.011	(0.043)	−0.009	(0.043)	−0.007	(0.043)
Some college							0.015	(0.041)	0.017	(0.040)	0.016	(0.041)
Family size							−0.041***	(0.012)	−0.041***	(0.012)	−0.042***	(0.012)
Urban							0.112**	(0.042)	0.112**	(0.042)	0.111**	(0.042)
Household income							−0.017*	(0.008)	−0.018*	(0.008)	−0.017*	(0.008)
Worked							0.056	(0.047)	0.051	(0.046)	0.048	(0.047)
Interaction effects: COVID restrictions												
×Preexisting conditions									0.009***	(0.002)		
×Job insecurity											0.005*	(0.002)
Constant	0.060**	(0.020)	0.066**	(0.020)	0.082***	(0.019)	−0.336***	(0.062)	−0.336***	(0.062)	−0.334***	(0.062)
Random effects												
-2LL	43 214		41 677		40 931		38 525		38 444		38 500	
Level-1 variance component	1.107		0.997		0.948		0.805		0.800		0.803	
Level-2 variance component	0.007***		0.007***		0.007***		0.006***		0.005***		0.006***	

COVID Impact Survey (W1 and W2); ***$P < 0.001$, **$P < 0.01$, *$P < 0.05$, #$P < 0.1$ (two-tailed tests). Coef., coefficient; SE, standard error.

Table 3 Random intercept and random slope models predicting 'Mental distress' (level-1 and level-2 variables)

	Model 1		Model 2		Model 3		Model 4		Model 5	
	Coef.	(SE)	Coef.	(SE)	Coef.	(SE)	Coef.	(SE)	Coef.	(SE)
Individual level										
COVID restrictions	0.027***	(0.004)	0.013*	(0.005)	0.012	(0.007)	0.027***	(0.004)	0.021***	(0.005)
Preexisting conditions	0.156***	(0.010)	0.086***	(0.018)	0.156***	(0.010)	0.157***	(0.010)	0.157***	(0.010)
Job insecurity	0.087***	(0.014)	0.088***	(0.014)	0.047*	(0.021)	0.088***	(0.014)	0.087***	(0.014)
Age	−0.223***	(0.011)	−0.221***	(0.011)	−0.222***	(0.011)	−0.223***	(0.011)	−0.223***	(0.011)
Female	0.138***	(0.031)	0.140***	(0.031)	0.138***	(0.031)	0.137***	(0.031)	0.138***	(0.031)
White	0.219***	(0.034)	0.218***	(0.034)	0.220***	(0.034)	0.223***	(0.034)	0.221***	(0.034)
BA and above	−0.008	(0.043)	−0.005	(0.043)	−0.004	(0.043)	−0.006	(0.043)	−0.008	(0.043)
Some college	0.018	(0.041)	0.020	(0.041)	0.018	(0.041)	0.019	(0.041)	0.018	(0.041)
Family size	−0.041***	(0.012)	−0.041***	(0.012)	−0.041***	(0.012)	−0.041***	(0.012)	−0.041***	(0.012)
Urban	0.105*	(0.042)	0.105*	(0.041)	0.104*	(0.041)	0.101*	(0.042)	0.102*	(0.042)
Household income	−0.018*	(0.008)	−0.018*	(0.008)	−0.018*	(0.008)	−0.018*	(0.008)	−0.018*	(0.008)
Worked	0.058	(0.047)	0.053	(0.046)	0.050	(0.047)	0.061	(0.046)	0.059	(0.046)
Region-wave level										
W2	−0.074*	(0.034)	−0.075*	(0.033)	−0.075*	(0.034)	−0.054	(0.038)	−0.078*	(0.034)
Regional lockdown	0.055	(0.034)	0.055	(0.034)	0.055	(0.034)	0.055	(0.039)	0.056	(0.037)
Infected cases	0.033**	(0.012)	0.034**	(0.012)	0.033**	(0.012)	0.038**	(0.013)	0.036**	(0.012)
(Interaction effects)										
COVID restrictions										
×Preexisting conditions			**0.009*** **	**(0.002)**						
×Job insecurity					**0.005***	**(0.002)**				
×W2									**0.012 #**	**(0.007)**
Constant	−0.313***	(0.063)	−0.314***	(0.063)	−0.312***	(0.063)	−0.331***	(0.064)	−0.316***	(0.063)
Random effects										
-2LL	38 516		38 435		38 491		38 497		38 491	
Level-1 variance component	0.805		0.801		0.804		0.804		0.804	
Level-2 variance component	0.002***		0.001***		0.001***		0.001***		0.001***	
COVID restrictions random slope							0.000***		0.000**	

COVID Impact Survey (W1 and W2); ***$P < 0.001$, **$P < 0.01$, *$P < 0.05$, #$P < 0.1$ (two-tailed tests). Coef., coefficient; SE, standard error.

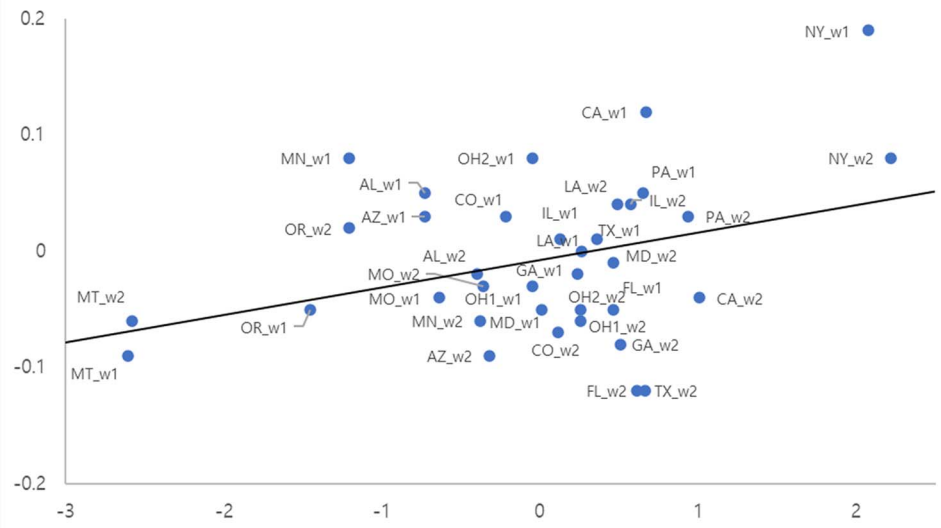

Fig. 1 COVID confirmed cases (*x*-axis) and average depression level (*y*-axis) across region-wave units.

Results

Random intercept models with level-1 covariates only

According to Model 1 in Table 2, there is significant variation in the outcome variable across the contextual units, justifying the use of multilevel modeling ($\tau = 0.01$; df = 35; $\chi^2 = 195.482$; $P < 0.001$). We thus proceed in Model 2 by including 'COVID restrictions', which is positively significant ($b = 0.035$; $P < 0.001$), showing that one-unit increase (an additional restriction) raises the distress level (in terms of factor score) by 0.035. In Model 3, the two moderators are added. Objective vulnerability ('Preexisting conditions') is positively related to mental distress ($b = 0.122$; $P < 0.001$), as is subjective vulnerability or 'Job insecurity' ($b = 0.023$; $P < 0.05$). The effect of social isolation as gauged by restricted mobility on the outcome measure remains robust ($b = 0.038$; $P < 0.001$), even after including these two additional predictors. For a more conservative test, we introduce the set of socioeconomic and demographic controls in Model 4. Except for the education dummies and employment status, they are all statistically significant. On the one hand, age, family size and household income are negatively related to psychological distress; on the other, being female and white and living in an urban area are positively related to it. Inclusion of these confounders does not reduce the significance levels of the associations found in Model 3 with respect to 'COVID restrictions', 'Preexisting conditions' and 'Job insecurity'. Having examined these relationships, we now turn to this study's primary focus: the moderation effects involving these three variables. According to Model 5, we find that the interaction between 'COVID restrictions' and 'Preexisting conditions' is positive and significant ($b = 0.009$; $P < 0.001$), i.e., the impact of social isolation on distress is greater for the physically vulnerable in support of **H1**. Model 6 shows a similar result concerning the interaction between 'COVID restrictions' and 'Job insecurity' ($b = 0.005$; $P < 0.05$). The impact is also greater for those who feel financially insecure, which supports **H2**.

Random intercept and coefficient models with additional level-2 covariates

In Table 3, as a robustness check, we incorporate the level-2 covariates. Model 1 shows that the parameter estimates for 'Infected cases' and W2 are both significant but in opposite directions. First, the total number of infections covary positively with the average level of 'Mental distress' across 36 region-wave units ($b = 0.033$; $P < 0.01$). Figure 1 graphically illustrates this relationship. The state of New York during W1 (NY_w1), for example, has the highest score on the distress index. At the other end of the spectrum is the state of Montana during W1 (MT_w1) with the lowest score, both in terms of the number of infections and the average distress level. Second, there is a difference in the average mental distress across the two waves of data. Specifically, it is lower for W2, as indicated by the negative sign of the coefficient ($b = -0.739$; $P < 0.05$). Although holding constant these additional level-2 controls, we re-estimate the two interaction terms discussed above. Results for the moderating roles of 'Preexisting conditions' ($b = 0.009$; $P < 0.001$) and 'Job insecurity' ($b = 0.005$; $P < 0.05$), as shown in Models 3 and 4, respectively, are consistently robust, lending further support for our hypotheses. The random slope coefficient for 'COVID

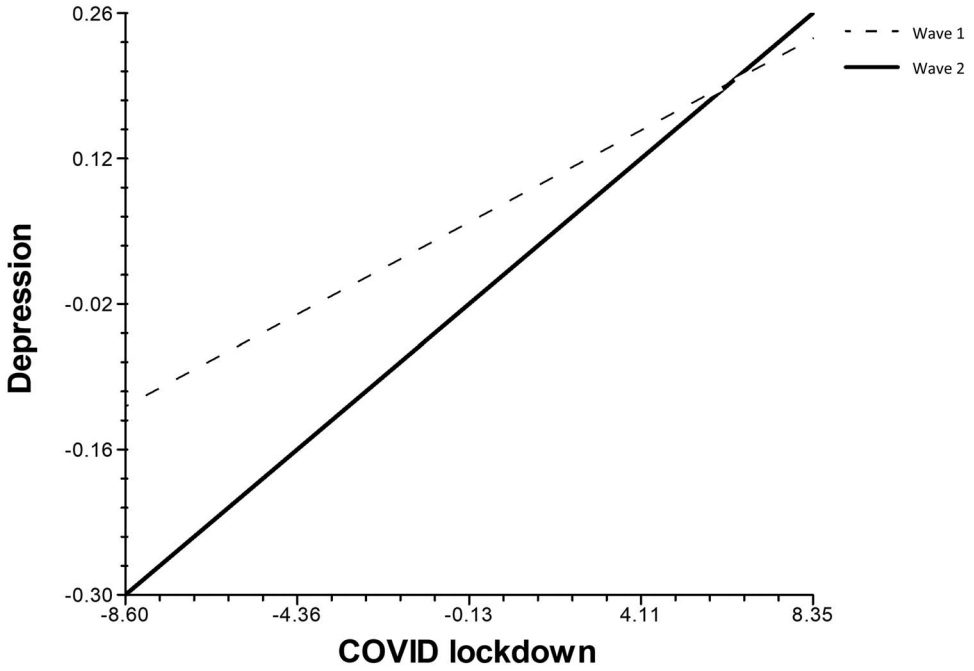

Fig. 2 The conditional impact of COVID lockdown measures on depression (mental distress) across W1 and W2.

restrictions' in Model 4 ($b = 0.027$; $P < 0.001$) also confirms that the impact is not constant but varies across region-wave units. To answer our **RQ**, we turn to the main finding in Model 5, where the cross-level interaction term ('COVID restrictions' × W2) is positive and significant, albeit marginally ($b = 0.012$; $P < 0.1$). We thus conclude that there is limited evidence for an increased negative effect of social isolation over time (see Fig. 2).

Discussion

Main findings of this study

This study demonstrates the toll the coronavirus pandemic has taken on the mental health of American adults via restrictions to activities emerging from the imposition of social distancing. Specifically, the more severely individuals experienced movement restrictions in their everyday lives, the higher their reported levels of mental distress. Far from abating, there is some evidence that this impact may be worsening over time. Moreover, the findings clearly demonstrate that this toll has not been shared equally across all people. Rather, more vulnerable individuals, particularly those with preexisting health conditions and those perceiving greater employment precarity, suffered a disproportionately greater impact of 'COVID restrictions' on their mental health.

What is already known on this topic

The onset of the coronavirus pandemic, and the ensuing lockdown restrictions, has coincided with a significant worsening in the mental health of societies. 'Social isolation', a significant byproduct of movement restrictions, has not been borne equally among individuals. With respect to previous pandemics, this has particularly been the case with respect to black and minority ethnic communities,[19] and we are witnessing a similar phenomenon with respect to COVID-19 when it comes to the physically and/or financially vulnerable.[9] Indeed, contrary to initial expectations, COVID-19 is not a social equalizer but an egregious magnifier of social inequality.[20–21]

What this study adds

Evidence generally suggests that less privileged segments of the population are more prone to infection and mortality. However, as of now, 'little is known about the consequences of social distancing (p.1)'.[22] Based on multilevel analysis, this study provides original insights into the conditional association between lockdown experience and mental distress in the USA Unlike most prior research, it uses two waves of probability data to offer a more dynamic analysis. A central finding is that the effects of COVID-induced restrictions are not fixed but variable. *Ceteris paribus*, the physically weak and the economically precarious are shown to be especially at risk. In addition, our study makes clear that people's mental wellbeing appears to respond to the trajectory of the virus' impact across their regional context over time. Where the reported impact has been stronger in a region (as measured by number of cases), residents' average distress level is

correspondingly higher. The severity of the virus' impact in one's wider social environment, and the anxiety that likely induces, is a key channel through which the pandemic has harmed individual wellbeing. In other words, aside from individual-level factors, geography matters.

Conclusions

Health outcomes are intricately tied to income and other indicators of socioeconomic status. And the current pandemic has laid bare this inconvenient truth. According to a United Nations policy brief on COVID-19,[2,3] 'pre-existing inequalities . . . are differentiating its impact'. The current study corroborates this observation. Specifically, using a large representative US sample, we demonstrate that the 'pre-existing inequalities' in health status and job stability moderate, i.e., amplify, the deleterious psychological consequences of the coronavirus-induced movement restrictions. In our research, we used cross-sectional data which, by definition, entails a thorny problem of endogeneity (reverse causality). Longitudinal data are needed to better assess and address the unequal implications of the coronavirus across social strata within and across countries throughout the world.

Acknowledgments

We would like to thank the Data Foundation for publicly releasing the Corona Impact Survey. We also appreciate Jennifer Benz, Deputy Direct at NORC, for her helpful assistance on a technical matter concerning the data.

Funding

This work was supported by the Economic and Social Research Council (grant number: ES/S013121/1) and the Alexander von Humboldt Foundation (Ref: GBR 1195617 HFST-E).

References

1 United Nations Development Programme. *Human Development Perspectives: COVID-19 and Human Development: Assessing the Crisis, Envisioning the Recovery*. New York: UNDP, 2020.

2 World Health Organization. *Facing Mental Health Fallout from the Coronavirus Pandemic*. https://www.who.int/news-room/feature-stories/detail/facing-mental-health-fallout-from-the-coronavirus-pandemic (29 May 2020, date last accessed).

3 Vindegaard N, Benros ME. COVID-19 pandemic and mental health consequences: systematic review of the current evidence. *Brain Behav Immun* 2020. doi: 10.1016/j.bbi.2020.05.048.

4 Vigo D, Patten S, Pajer K *et al.* Mental health of communities during the COVID-19 pandemic. *Can J Psychiatry* 2020. doi: 10.1177/0706743720926676.

5 Zhang Y, Ma ZF. Impact of the COVID-19 pandemic on mental health and quality of life among local residents in Liaoning Province, China: a cross-sectional study. *Int J Environ Res Public Health* 2020;**17**(7):2381.

6 Temsah MH, Al-Sohime F, Alamro N *et al.* The psychological impact of COVID-19 pandemic on health care workers in a MERS-CoV endemic country. *J Infect Public Health* 2020;**13**:877–82.

7 Johns Hopkins University & Medicine. *Coronavirus Resource Center*. https://coronavirus.jhu.edu/map.html (1 July 2020, date last accessed).

8 Centers for Disease Control and Prevention. *National Center for Health Statistics Household Pulse Survey*. https://www.cdc.gov/nchs/covid19/pulse/mental-health.htm (1 July 2020, date last accessed).

9 Alobouia WM, Dalva-Baird NP, Forrester JD *et al.* Racial disparities in knowledge, attitudes and practices related to COVID-19 in the USA. *J Public Health* 2020. doi: 10.1093/pubmed/fdaa069.

10 Wenham C, Smith J, Morgan R *et al.* COVID-19: the gendered impacts of the outbreak. *Lancet* **395**:846–8.

11 Raisi-Estabragh Z, McCracken C, Bethell M *et al.* Greater risk of severe COVID-19 in black, Asian and minority ethnic populations is not explained by cardiometabolic, socioeconomic or behavioural factors, or by 25(OH)-vitamin D status: study of 1326 cases from the UK biobank. *J Public Health* 2020. doi: 10.1093/pubmed/fdaa095.

12 Pieh C, Budimir S, Probst T. *Mental Health during COVID-19 Lockdown: A Comparison of Austria and the UK*. doi: 10.2139/ssrn.3592372 (4 May 2020, date last accessed).

13 Pfefferbaum B, North CS. Mental health and the Covid-19 pandemic. *N Engl J Med* 2020. doi: 10.1056/NEJMp2008017. 13 April 2020.

14 Harlem G, Lynn M. Descriptive analysis of social determinant factors in urban communities affected by COVID-19. *J Public Health* 2020. doi: 10.1093/pubmed/fdaa078.

15 Kirby T. Evidence mounts on the disproportionate effect of COVID-19 on ethnic minorities. *Lancet Respir Med* 2020;S2213–600 30228–9.

16 Ebrahim S. *Covid-19: The greatest burden will fall on older people in low- and middle-income countries*. https://eiuperspectives.economist.com/healthcare/covid-19-greatest-burden-will-fall-older-people-low-and-middle-income-countries (30 June 2020, date last accessed).

17 World Health Organization. *Mental Health and Psychosocial Considerations During the COVID-19 Outbreak*. https://www.who.int/teams/mental-health-and-substance-use/covid-19 (18 March 2020, date last accessed).

18 Raudenbush SW, Bryk AS, Cheong YF *et al. HLM 8 for Windows [Computer Software]*. Skokie, IL, Inc: Scientific Software International, 2011, 2019.

19 Pareek M, Bangash MN, Pareek N *et al.* Ethnicity and COVID-19: an urgent public health research priority. *Lancet* 2020. https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(20)30922-3/fulltext.

20 Oxfam International. *How the Coronavirus Pandemic Exploits the Worst Aspects of Extreme Inequality*. https://www.oxfam.org/en/how-coro

navirus-pandemic-exploits-worst-aspects-extreme-inequality (11 July 2020, date last accessed).

21 Przeworski A. *COVID-19: A Magnifier of Social Inequality*. Graduate Institute Geneva. Global Governance Center. https://graduateinstitute.ch/coronavirus-information-our-community-and-visitors/covid-19-magnifier-social-inequality. (10 June 2020, date last accessed).

22 Melo M, Soares D. Impact of social distancing on mental health during the COVID-19 pandemic: an urgent discussion. *Int J Soc Psychiatry* 2020. doi: 10.1177/0020764020927047.

23 United Nations. *COVID-19 Pandemic Exposes Global 'Frailties and Inequalities': UN Deputy Chief*. UN News (Global perspective, Human stories) https://news.un.org/en/story/2020/05/1063022 (3 May 2020, date last accessed).