

Economic hardship and mental health complaints during COVID-19

Dirk Witteveen^{a,1}  and Eva Velthorst^{b,c} 

^aNuffield College, University of Oxford, Oxford OX1 1NF, United Kingdom; ^bDepartment of Psychiatry, Icahn School of Medicine at Mount Sinai, New York, NY 10029; and ^cSeaver Autism Center for Research and Treatment, Icahn School of Medicine at Mount Sinai, New York, NY 10029

Edited by Douglas S. Massey, Princeton University, Princeton, NJ, and approved September 16, 2020 (received for review May 13, 2020)

The COVID-19 economic crash is idiosyncratic because of its virtual standstill of economic activity. We therefore ask how individual labor market experiences are related to the development of mental health complaints in the spring of 2020. As clinical data collection was compromised during the lockdowns, standardized surveys of the European labor force provide an opportunity to observe mental health complaints as the crisis unfolded. Data are representative of active members of the labor force of six European nations that contained varying levels of COVID-19 burdens in terms of mortality and lockdown measures. We document a steep occupational prestige level gradient on the probability of facing economic hardship during the lockdowns—looming job loss, income loss, and workload decline—which evidently exacerbate socioeconomic inequalities. Analyses indicate a striking positive relationship between instantaneous economic hardships during the COVID-19 lockdown and expressing feelings of depression and health anxiety. Importantly, the magnitude of the association between such hardships and indicators of mental health deterioration is highly dependent on workers' occupational standing, revealing a second layer of exacerbating inequality.

depressive symptoms | health anxiety | COVID-19 | recession | labor market inequality

The COVID-19 crisis considerably impacted social life across the globe during the spring of 2020. Its economic shock took off soon after the initial outbreak of the pandemic. International trade slowed down and financial markets plunged as early as February 2020 (1, 2). Subsequently, labor markets were affected by government-imposed lockdowns from mid-March onward. The lockdown measures included self-quarantines, restrictions on mobility, and widespread closures of businesses in the service industry, excepting essential occupations. Despite the fact that most advanced economies rely on high-tech industries and (semi) managerial jobs (3), substantive segments of the labor market remained unable to adapt. Hence, from one day to another, many employed members of the labor force faced a heavily reduced workload, temporary inactivity (e.g., furloughs), or even job loss.

The sudden economic standstill can pose enormous challenges for the mental health of workers. Apart from an increased risk of loneliness resulting from social isolation (4), various socioeconomic groups may be particularly vulnerable to COVID-19–induced anxiety and feelings of depression due to existing threats of job loss and financial loss (5). The widespread labor market detachment begs the question as to who gets exposed to forms of COVID-19–induced economic hardship, such as instantaneous income loss and workload decrease, and whether this triggers mental health complaints. Making use of a COVID-19 supplement of existing surveys conducted among the labor force in several European countries, run since the start of lockdowns, the current study analyzes the combination of individuals' occupational positions and exposure to economic hardship on the development of mental health complaints: feelings of depression, loneliness, and health anxiety. We argue that assessment of the association between labor market position and mental health

contributes to our understanding of the pandemic's impact on existing, as well as instantly emerging, socioeconomic inequalities.

Macroeconomic downturns are known to exacerbate existing economic inequalities along status groups, notably, social class and occupation (6–8), which some have suggested will also be the case for the COVID-19 recession (9). Extant research indicates that modern-day economic recessions are triggers of a range of mental health symptoms, as is visible in the fluctuations of aggregate health indicators across periods of economic growth and recession (10–12). Studies have also identified a causal relationship between job loss and declines in psychological and physical well-being (13, 14). Importantly, the risks of experiencing these secondary detrimental effects of recessions are not equally distributed. Significant social class gradients appear in the prevalence of a variety of mental health disorders in contexts of steep macroeconomic decline (15, 16). Researchers have also found that at least a large component of these effects is driven by feelings of shame and fear of a looming job loss (17), and thus highly depend on one's relative position in the labor market.

Compared to earlier recessions, the COVID-19 economic downturn is rather idiosyncratic because of its collective character and instant appearance. The instantaneously implemented lockdowns and business suspensions likely differentially impacted workers, partially depending on their jobs being qualified as essential by governments or transferrable to remote work formats by employers. It is therefore ever more important to take into consideration individuals' relative positions in the labor market when assessing the relationship between economic hardship and mental health. This study is focused on the active members of the labor

Significance

This study measures the impact of the COVID-19 lockdowns on workers' economic hardship and mental health. In data representative of the active labor force, we document two interconnected layers of rapidly exacerbating inequalities. We find that occupational ranking is highly predictive of experiencing a range of instant economic hardships, such as workload decrease and income loss. Subsequent analyses indicate that such economic hardships lead to much higher prevalence of expressing adverse mental health, including feelings of depression and health anxiety. As the unprecedented societal shock of COVID-19 bears little comparison with prior economic recessions, we assert survey data of the labor force are paramount in understanding how workers' mental health complaints came about.

Author contributions: D.W. and E.V. designed research, performed research, analyzed data, and wrote the paper.

The authors declare no competing interest.

This article is a PNAS Direct Submission.

Published under the PNAS license.

¹To whom correspondence may be addressed. Email: dirk.witteveen@nuffield.ox.ac.uk.

This article contains supporting information online at <https://www.pnas.org/lookup/suppl/doi:10.1073/pnas.2009609117/-DCSupplemental>.

First published October 12, 2020.

force, estimating the impact of experiencing a shock to one's employment situation—during the COVID-19 economic crash—on the development of mental health complaints. This relationship is assessed across different occupational prestige levels. Specifically, we consider three forms of economic hardship (workload change, income loss, and job loss) and three types of mental health complaints: feelings of depression, loneliness, and health anxiety.

The analysis first examines the probabilities of experiencing economic hardship during the COVID-19 lockdown and expressing adverse mental health complaints along occupational prestige levels. These occupational gradients yield insight into the risk distribution of instant labor market detachment, and thereby the exacerbation of existing inequalities. Fig. 1 visually presents our identification strategy. We theorize that relative occupational position is negatively associated with the probability of both (arrow a) experiencing an economic hardship during the COVID-19 lockdown and (arrow b) expressing mental health complaints. Subsequently, we seek to identify the effect of exposure to economic hardship during the COVID-19 lockdown on mental health complaints (arrow c). As shown in Fig. 1, we assume that experiencing an instant economic hardship is a proximate cause of mental health complaints—that is, a negative direct effect. Taking into consideration the modification role of socioeconomic position in the relationship between exposure and outcome, we also examine variation in magnitude of the economic hardship effect across different levels of occupational prestige (International Socio-Economic Index [ISEI]).

Results

Occupational Prestige. Data were drawn from surveys of the labor force in Italy, Spain, Czech Republic, Slovakia, Netherlands, and Germany across March and April 2020 (*SI Appendix, Fig. S1*). We selected active members of the labor force as the study sample. Respondents' relative labor market position was measured using an occupational prestige score: the commonly used ISEI of occupations (scale range 10 to 89). These prestige scores do not contain value judgments, but instead represent a weighted score of each occupation's earnings level and skill level. The ISEI effectively reflects the level of socioeconomic vulnerability (toward the lower end of the scale) or protection (toward the higher end of the scale) of all current-day occupations. Examples of occupations and ISEI scores are domestic cleaners (10), manufacturer laborers (20), package deliverers (30), clerks (40), web technicians (50), primary school teachers (60), managing directors (70), university researchers (80), and medical specialists

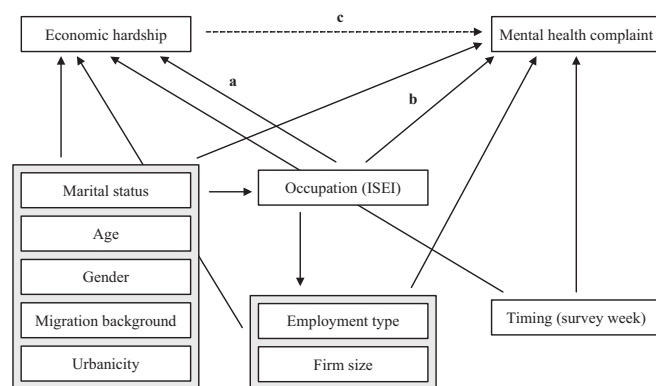


Fig. 1. Graphical representation of the identification strategy. Arrows a and b reflect the occupational prestige gradients in economic hardship and mental health complaints. Arrow c represents the effect of economic hardship during COVID-19 on mental health complaints—the primary treatment effect of this study.

(89). The mean ISEI in our sample is 53.1 (*SI Appendix, Fig. S1* contains all descriptive statistics).

Occupational Prestige Level and Economic Hardship. A first series of multivariate models were fitted to the data to test the significance of the association between occupational prestige level and three forms of economic hardships. We present the predicted marginal effects of experiencing 1) workload decrease, 2) income loss, and 3) job loss, adjusted for covariates of sociodemographics (gender, age, migration background), the type of employment relation (status and firm size), respondent's location (urbanicity), and timing of the interview (survey week).

As shown in Fig. 24, occupational prestige score (ISEI) is significantly negatively associated with the predicted probability of a reduced workload ($\beta = -0.00652$, $P < 0.001$). This is a rather steep class gradient, to be interpreted as a 6.5 percentage point decrease in the predicted probability of workload reduction per 10-point upward shift on the occupational prestige axis. We deduce, from these estimates, that involuntary reduced work hours during the initial phase of the economic crash were concentrated in lower prestige-ranked occupations. Conversely, a higher occupational prestige is positively associated with stable ($\beta = 0.0045$, $P < 0.001$) workloads, net of all control variables. This means that workers in higher prestige-ranked occupations are more likely to have maintained similar levels of work hours during the lockdown.

Predicted probabilities of both losing income (Fig. 2B) and losing employment (Fig. 2C) during the peak of the COVID-19 economic crash also display significant occupational prestige gradients. We find that a higher occupational ISEI yields a significantly lower propensity to face abrupt loss of income ($\beta = -0.00682$, $P < 0.001$), as well as a substantially lower propensity for job loss ($\beta = -0.00283$, $P < 0.001$). Mirroring the socioeconomic inequality of reduced workloads, these graphs visually demonstrate that lower-ranked occupations (ISEI of ~ 30) exhibit much higher risks of economic hardship—a chance about twice as high in comparison to middle- and higher-ranked jobs (ISEI of ~ 80).

A closer assessment of the contributions of all modeled covariates of economic hardships (*SI Appendix, Fig. S2*) revealed extraordinarily high marginal effects of being freelance or self-employed on the likelihood a workload decrease (+32.2 percentage points), income loss (+42.0 percentage points), and job loss (+19.5 percentage points), relative to employees. These employment type estimates were robust to effects of occupational prestige and all other controls. Analyses further indicate that employees (relative to employers) were more likely to experience reduced workloads and income loss. However, the effect sizes should be interpreted with some caution given the small size and diverse character of this labor force segment (2%).

Occupational Prestige Level and Mental Health Complaints. Incidence rates of feelings of depression, feelings of loneliness, and health anxiety that emerged during March and April of 2020 are 26.2%, 26.5%, and 37.5%, respectively. We regressed each of these mental health complaints on the occupational prestige scores (ISEI), net of control variable matrices. Predictive models of feelings of loneliness did not contain a significant effect of occupational position (*SI Appendix, Fig. S3*).

Fig. 34 indicates that occupational prestige is negatively associated with feelings of depression during the COVID-19 crisis, as reflected by the noticeable steep downward slope ($\beta = -0.0033$, $P < 0.001$). Thus, while 26.2% of all surveyed respondents reported feeling depressed, moving up only 10 points on the occupational prestige scale reduces one's chance of stating such a complaint by 3.3 percentage points. We therefore infer that individuals in lower prestige-ranked jobs—that is, lower-income

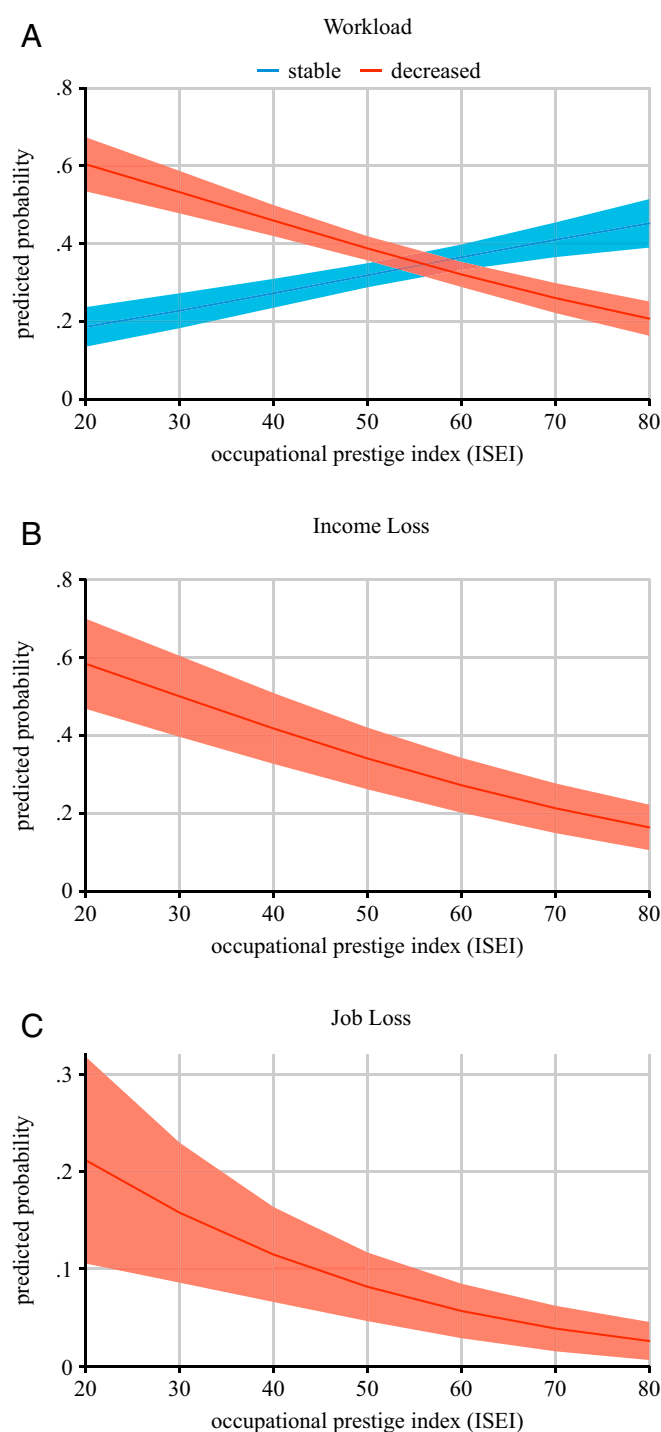


Fig. 2. Predicted probabilities of occupational prestige affecting economic hardship during COVID-19. (A) Workload change regressed on occupational prestige level. (B) Income loss regressed on occupational prestige level. (C) Job loss regressed on occupational prestige level. Marginal effects are drawn from multinomial logit (workload change) and logit (income loss, job loss) regressions with country-random intercepts. Workload change consists of stable (reported), decreased (reported), and increased (suppressed; *SI Appendix, Fig. S1*). Estimates are adjusted for age, age squared, gender, migration background, employment status, firm size, urbanicity, and timing/survey week number (*SI Appendix, Fig. S2*). Shaded areas represent 95% CIs (two-tailed tests).

or lower-educated—are at much higher risk of stating having developed depressive feelings during the COVID-19 lockdown.

We also find that occupational prestige ranking is negatively predictive of expressing a fear of getting sick—for example, contracting the coronavirus. The ISEI slope (β) in Fig. 3B was estimated to be -0.0029 ($P < 0.01$), which effectively means a 2.9 percentage point increase in the chance of avoiding anxiety about getting sick per 10 points upward on the occupational prestige scale. The likelihood of health anxiety appears to be about twice as high for individuals in the lower-status jobs, on the left-hand side of the horizontal axis, as compared to individuals in managerial professions—positioned on the rightmost side of Fig. 3B. This may suggest that individuals in higher prestige-ranked occupations were more protected against health anxiety during the peak of the COVID-19 outbreak.

The control variables that are used to optimize our estimates of occupational effects yield several noteworthy associations with rapidly emerging mental health complaints (*SI Appendix, Fig. S4*). Net of the main ISEI association, being an employer instead of an employee, significantly increases the chance of depression complaints (+23.0 percentage points). Also, living in a large city significantly increases the likelihood of developing health anxiety (+8.1 percentage points), as contrasted with small cities or towns. Furthermore, not having a spouse or partner living in the same household significantly increases the chance of expressing feelings of loneliness (+15.7 percentage points).

We also tested a model that additionally controlled for respondents' history of depression or anxiety (*SI Appendix, Fig. S4*). Including this self-reported indicator of life course mental health noticeably attenuates the ISEI associations, yet they persist as strong significant predictors of having developed mental health complaints in the spring of 2020. This means that the steep occupational prestige gradients in the reported psychological well-being (Fig. 3) are only partially attributable to individuals' propensity for mental health risks.

Economic Hardship and Feelings of Depression. Multivariable models were fitted to test the hypothesized positive relationship between economic hardship during the COVID-19 lockdown and mental health complaints. The results for recent onset depressive feelings are plotted in Fig. 4, organized by economic hardship predictor.

As shown in Fig. 4A, the predicted probabilities of depression feelings are substantially higher for workers who experienced a sudden decreased workload (28.8%) as compared to their counterparts who maintained stability in employment (20.2%). In other words, deviating from regular work hours during the COVID-19 economic crash yields a 1.5 relative risk of stating feelings of depression. The adjacent Fig. 4B predicts the marginal effects by occupational prestige level. While the gaps between the workload categories remain statistically nonsignificant within each level, the point estimates are noticeably higher and farther separated in the lowest ISEI tertiles. This suggests that the positive associations between experiencing a decreased workload during the COVID-19 lockdowns and feelings of depression were somewhat stronger among the most vulnerable socioeconomic groups in the labor market.

Fig. 4C plots the point estimates of the probability of depression feelings for income loss, holding maintaining a stable income during the lockdown as the reference category. Fig. 4C indicates a significantly ($P < 0.001$) higher chance of feelings of depression in the case of an instant loss of income (33.2%) as compared to maintaining income (21.5%), net of the control variable matrices. Importantly, as shown in Fig. 4D, the effects vary in magnitude across occupational prestige levels. The probability estimates of depression feelings for losing income are progressively higher at lower levels of ISEI. Furthermore, the predicted probability gap of depression feelings appears larger in

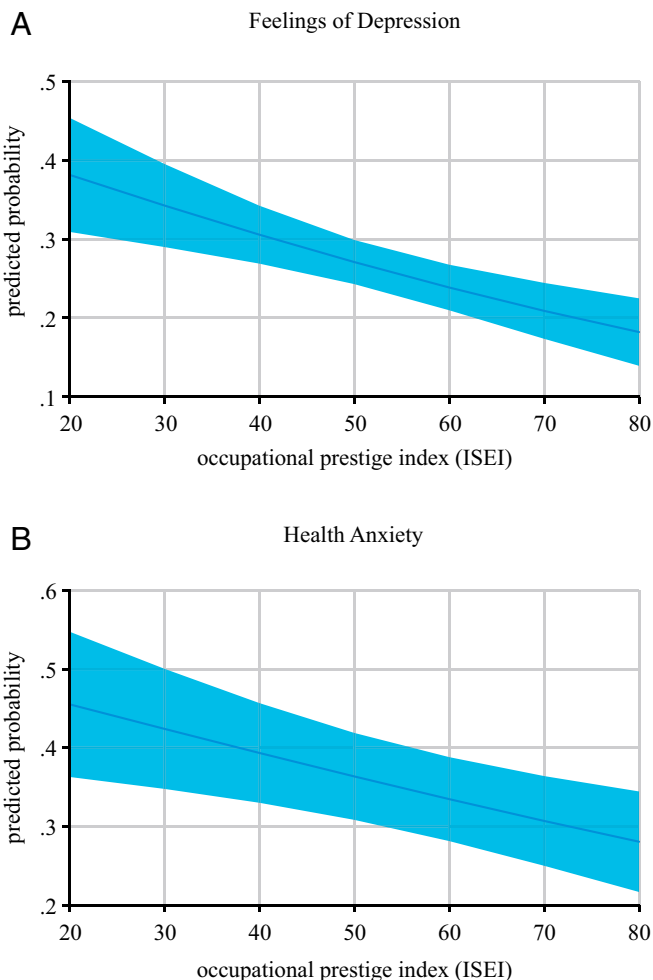


Fig. 3. Predicted probabilities of occupational prestige affecting mental health complaints. (A) Feelings of depression regressed on occupational prestige level. (B) Health anxiety regressed on occupational prestige level. Marginal effects are drawn from logit regressions (dichotomous indicator of complaints) with country-random intercepts. Estimates are adjusted for age, age squared, gender, migration background, partner (in household), employment status, firm size, urbanicity, and timing/survey week number. Further adjusting for prior depression or anxiety attenuates ISEI coefficient without losing significance (*SI Appendix, Fig. S4*). Shaded areas represent 95% CIs (two-tailed tests).

the lower and middle ISEI tertiles (although not statistically significant).

Fig. 4 *E* and *F* presents the main effect and modification by occupational prestige level, respectively, of experiencing job loss on reporting feeling depressed. We find that losing one's job during the COVID-19 economic crash is predictive of a 16.6 percentage point higher predicted probability of feelings of depression than job retention (39.3% vs. 22.7% [$P < 0.01$], respectively). In other words, instantly losing income and/or employment during the peak-pandemic lockdowns almost doubled the risk of feelings of depression. Moreover, as shown in the adjacent graph, experiencing job loss in the lowest ISEI tertile (43.3%) and the middle ISEI tertile (39.8%) yields a significantly higher chance of reporting feelings of depression as compared to the highest ISEI tertile (7.2%).

Economic Hardship and Health Anxiety. The significance tests for the relationship between the economic hardships and loneliness failed to reject the null hypothesis.

We further expected that instant changes in workload would be predictive of having developed a fear of getting sick—that is, contracting the coronavirus. Specifically, we hypothesized that taking on more hours during the COVID-19 lockdowns would create stressful work situations that presumably contain more face-to-face interactions compared to stable or lower work hours. Fig. 5*A* documents an evident main effect of an increased workload on the probability of health anxiety ($P < 0.001$). Adjusting for all control variables, and holding “stable workload” as the reference category, heavier workloads increase the risk of developing fears of getting sick during the COVID-19 economic crash. More precisely, work schedules that have gotten busier—such as working longer hours or more days—are associated with a predicted probability of 41.5% of developing health anxiety. This propensity is significantly higher than for workers with stable work hours, who have a predicted probability of 26.7% of reporting health anxiety.

Fig. 5*B* plots the effects of workload changes on health anxiety, by occupational prestige levels. We find that the sharpest gaps in the point estimates between workloads appear among workers within both lower and higher prestige-ranked occupations. Most striking is the significantly higher chance of health anxiety associated with an increased workload (52.3%) among workers in the lowest ISEI tertile. This marginal effect is significantly stronger compared to workers with stable work hours in the same ISEI level ($P < 0.001$), as well as compared to workers with increased workloads in the middle and high ISEI groups (not statistically significant). Workload increases were far from uncommon during the COVID-19 economic crash and appeared across the occupational prestige scale. However, in so far as increased workloads explain higher levels of health anxiety, this induced risk seems to fall disproportionately on the most vulnerable workers in the labor force.

Robustness. A series of robustness checks were conducted (*SI Appendix, Figs. S3 and S5*). First, we find that our key findings are not sensitive to the use of poststratification weighting and thus exhibit external validity. Second, all presented estimation models contain country-random intercepts, which allow the baselines of the slopes to vary across countries. Sensitivity analyses excluded the possibility that the results are driven by unique relationships between the occupational distribution, economic hardships, and mental health complaints in any of the six countries studied. Third, while the main set of analyses listwise-deleted cases with blank answers on economic hardship questions, assuming the default categories does not substantively shift the estimates. Fourth, as this study generalizes to the active labor force upon the initial COVID-19 crash, the 18- to 24-y age group was excluded because of the complexity regarding the meaning of their (un)employment; that is, some are student side jobs, while others are career jobs. However, we arrive at the same substantive findings if younger workers are included in the analysis. Fifth, we also excluded the possibility that our findings are driven by the extent to which some professions have been excluded from most governments' business shutdowns, such as public transport workers and medical workers. Exploring mental health consequences of individual professions is beyond the scope of this study, but this is the subject of various ongoing investigations (e.g., ref. 18).

Conclusion

The COVID-19 pandemic caused immense socioeconomic turmoil in the spring of 2020, not only because of its imminent health threat but also as a result of necessary lockdowns and government-mandated suspension of much business activity. This study reveals the consequences of the latter, concentrating on the relationship between disturbances in labor market position and exposure to economic hardships, as well as the development

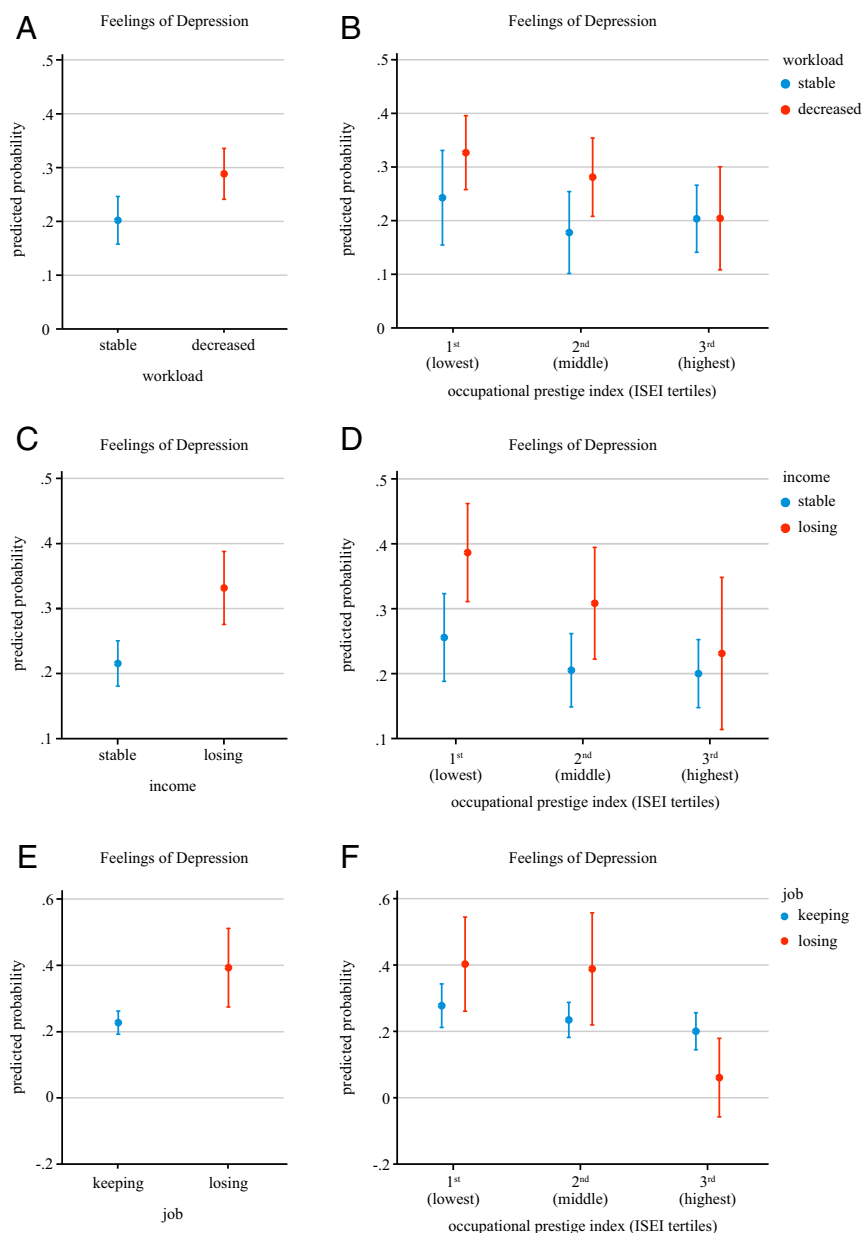


Fig. 4. Predicted probabilities of economic hardships during COVID-19 affecting depression complaints. (A) Marginal effect of workload change on feelings of depression. (B) Marginal effect of workload change on feelings of depression by ISEI level. (C) Marginal effect of income loss on feelings of depression. (D) Marginal effect of income loss on feelings of depression by ISEI level. (E) Marginal effect of job loss on feelings of depression. (F) Marginal effect of job loss on feelings of depression by ISEI level. Marginal effects are drawn from logit regressions with country-random intercepts. Estimates are adjusted for age, age squared, gender, migration background, partner (in household), employment status, firm size, urbanicity, and timing/survey week number. Interval bars represent 95% CIs (two-tailed tests).

of mental health complaints: feelings of depression, loneliness, and health anxiety. Utilizing unique survey data from six European countries, our study bears several important insights relevant to academic researchers of socioeconomic inequality and the consequences for mental health, as well as policy makers concerned with workers' psychological well-being.

Our results provide evidence for steep occupational gradients in the chances of experiencing economic hardship during the COVID-19 lockdowns and macroeconomic crash. Contrary to typical development of economic recessions, the impact of the COVID-19 crisis was widespread across the labor market and characterized by a virtual standstill in much economic activity.

Nonetheless, our analyses indicate that the economic burden disproportionately falls on the shoulders of workers in lower prestige-ranked jobs. These occupational gaps are seemingly larger than, for instance, the Great Recession. Individuals employed in lower prestige-ranked occupations—that is, lower-pay and lower-skill—were confronted with a much greater risk of workload decreases, income loss, and job loss that resulted from the lockdowns and business suspensions. The magnitudes of occupational prestige effects on economic hardships during the COVID-19 lockdown period are extraordinarily large, such that individuals in lower-ranked occupations had a risk of labor market detachments that was between 2 and 3 times higher

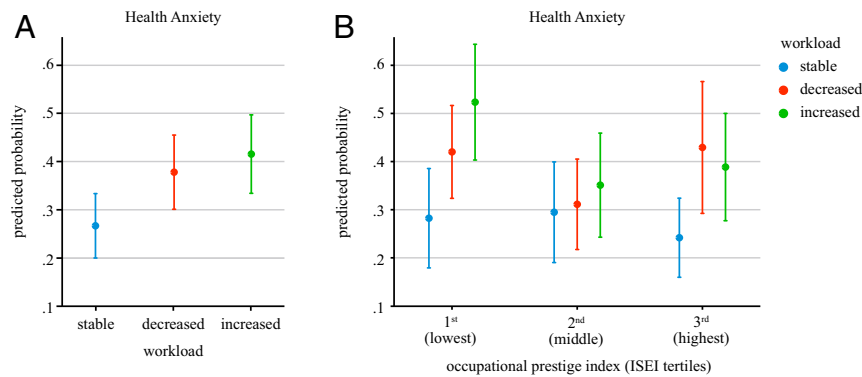


Fig. 5. Predicted probabilities of workload change during COVID-19 affecting health anxiety. (A) Marginal effect of workload change on feelings of depression. (B) Marginal effect of workload change on feelings of depression by ISEI level. Marginal effects are drawn from logit regressions with country-random intercepts. Estimates are adjusted for age, age squared, gender, migration background, partner (in household), employment status, firm size, urbanicity, and timing/survey week number. Interval bars represent 95% CIs (two-tailed tests).

compared to individuals employed in higher-skill and higher-pay jobs. Workers with flexible occupational positions, such as freelancers, are at even higher risks of instant labor market detachment. We thus observe a clear pattern of exacerbating socioeconomic inequality.

We also find occupational prestige score gradients in the mental health complaints that emerged during the spring of 2020. More specifically, individuals employed in lower prestige-ranked jobs face much higher propensities of feelings of depression and health anxiety that appeared during the COVID-19 lockdown. The magnitudes of these occupational gradients are large and persist after taking individuals' mental health history into consideration. We therefore conclude that occupational positions held prior to the COVID-19 pandemic played an important role in the varying propensities of developing new mental health complaints during the lockdown.

Our analysis further concentrates on the assumed proximate cause of emerging mental health complaints, finding evidence for a direct positive effect of economic hardships during the COVID-19 lockdown. That is, rapid changes in workload and instant loss of income and employment significantly increase the probabilities of reporting feelings of depression and health anxiety. Deviation from a stable employment situation yields a substantive 1.5 to 1.7 relative risk of depressive feelings. Importantly, we also find that the magnitudes of the association between experiencing instantaneous economic hardships and mental health complaints are partially dependent on one's relative position in the labor market. The effects on feelings of depression are progressively stronger among workers who are employed in the lower prestige-ranked occupations. In other words, the detrimental consequences of facing COVID-19-induced economic hardship for mental health are most salient for workers in the most vulnerable segments of European the labor market.

Regarding health anxiety, we find that workers with increased workloads are most evidently at risk for expressing fear of contracting the coronavirus and that this inequality, again, appears to be concentrated among workers in lower-ranked occupational prestige jobs. We assume such workers to be, for instance, deliverers, customer service operators, and cleaners in the health-care system, because physical distancing is likely to be compromised in these employment conditions. Finally, based on our results regarding loneliness, we predict that a large portion of the mental health problems are concentrated in cities and among individuals who do not have a partner or spouse living in the household. This finding is in keeping with a robust body of evidence suggesting a link between population density and

mental health (19), potentially by way of the number of stressful exposures and by social fragmentation (20).

A unique strength of this study is its assessment of large-scale individual-level data gathered since the beginning of the European lockdowns (mid-March) through the first relaxations of physical distancing measures (end of April). The COVID-19 economic downturn is difficult to compare to other recessions, as its impact on the labor market was instantaneous. It is therefore paramount to expose the mechanisms between occupational position, economic hardship, and mental health as the COVID-19 crisis unfolded. Moreover, the examination of the consequences of the social and economic standstill on mental health inequalities appeared across nationally representative data from nations with varying degrees of COVID-19 mortality rates and similar lockdown mandates.

We further stress the necessity of replication of occupational standing's associations with long-lasting mental health disorders in longitudinal samples. Inherent to large, multiple-purpose, cross-sectional samples, as used in the current study, one limitation is the trade-off between breadth and depth. As we were able to examine only three single-item and self-reported indicators of mental health in a relatively large and reliable sample of the labor force (21), researchers are encouraged to implement validated clinical measures in future study designs. In addition, researchers and practitioners of mental health who are used to collecting data during clinical visits may be increasingly dependent on alternative data gathering techniques, such as online surveys and phone and video calls, as long as the COVID-19 pandemic continues to affect social gatherings. These data could also be important to labor market policy makers and large employers responsible for the mental health of remote workers.

Taken together, we argue that existing labor market inequalities are doubly exacerbated during the COVID-19 economic crisis: first, through unequally distributed economic hardships across the labor force, and, subsequently, through mental health complaints that are triggered by the COVID-19 socioeconomic crash. We show that these staggering labor market inequalities emerged overnight—highly uncommon in modern-day recessions. We further argue that using survey data to detect pathways between economic hardships and mental health is ever more important, because lockdowns and physical distancing measures impede standard data gathering by social workers or clinical researchers during the COVID-19 pandemic. This may continue to be the case in the months and years after the initial economic crash of spring 2020.

Materials and Methods

Conceptual Considerations and Limitations. To be sure, the mental health indicators used in this study are not clinically confirmed and therefore cannot be directly included in a like-for-like comparison. Instead, they are measurements of mental health feelings—that is, complaints. These indicators consist of a series of single items, which poses a limitation for detailed measurement of mental health. It is important to note that the construction of our dependent variables is a consequence of using labor market surveys that were available during the lockdowns. These surveys are not specifically designed to capture mental health, and “gold-standard” questionnaires are therefore lacking. As a result, inequality researchers will have to rely on raw indicators of instant shifts in mental health status and occupation during the spring 2020 lockdowns, as done in the current study through self-reporting in cross-sectional data.

Future studies should compare our results to possible long-term mental health consequences and their occupational gradients which, in due course, could be supplemented with thorough clinical measurement after the lockdowns. Furthermore, there are several longitudinal panel studies and social surveys that were continuously collected throughout 2020. Depending on their data collection timing, these studies may be well equipped to further disentangle the complex relationships within a variety of pre-COVID-19 conditions, including assessment of the possibility of reverse causality, where life course mental health trajectories led to downward occupational mobility.

Data. Observational data are drawn from the WageIndicator Survey of Living and Working, selecting its Coronavirus Times 2020 supplement as filled out by web respondents between week 13 and week 18 of 2020 (22). The WageIndicator Foundation is a global research effort relying on a long-standing survey of the workforce running across 150 countries, with millions of visitors annually. It has produced reliable estimates of subjective well-being through a robust implementation of web survey techniques that generalize to the population level (23). Based on experience in prior studies using these data (24), unweighted estimates are reported. Poststratification weights were calculated using the European Social Survey of 2012–2016 (25), yet the robustness checks yielded the same substantive results (*SI Appendix, Fig. S3*).

Respondents' data from a total of six European countries were selected based on data availability (depending on WageIndicator's ability to roll out questionnaires from mid-March onward), survey sample size (at least 100 per country in order to fit multivariable models), and comparability (i.e., European countries): Italy, Spain, Czech Republic, Slovakia, Netherlands, and Germany (*SI Appendix, Fig. S1*). These countries contained a considerable variety of COVID-19 infections and deaths in March and April 2020 (26). While governments' guidelines of physical distancing varied to some extent, all countries were characterized by widespread work reductions and shutdowns of many industrial sectors and, by implication, their occupations. The study sample contains 1,012 adults, consisting of individuals who are actively participating in the European labor market. This is because of the analytical interest in the change in employment relation in response to the COVID-19 economic crash. Analyses include employed individuals who are between 25 y and 64 y old (mean age = 42.3 y). Younger respondents were excluded from the analyses to avoid conflation with educational participation and unobserved complexity regarding the meaning of their employment status and/or change.

Outcomes. Two series of outcomes (Y) are investigated. First, respondents' experienced economic hardship is measured by three distinct indicators: self-

reported income loss (dichotomous), job loss (dichotomous), and workload change (stable, decrease, increase). We mainly focus on workload decreases as stressor, as contrasted with stable workloads (reference category). All three variables are drawn from a series of survey questions that specifically refer to how respondents' labor market status changed due to the COVID-19 crisis (*SI Appendix, Fig. S6*). Second, respondents' mental health complaints are measured on a five-point Likert scale with single-item survey questions about feelings of depression (“I feel mentally depressed”), loneliness (“I feel lonely”), and health anxiety (“I am afraid that I will get sick”) during the COVID-19 lockdowns (March through April). These survey questions, too, referred specifically to COVID-19–induced changes in one's mental health. All three dependent variables were coded dichotomously (1 through 3 = no, 4 and 5 = yes) after assessment of the distributional form (*SI Appendix, Fig. S6*).

Predictors and Estimation. The occupational prestige score, reflecting relative position in the labor market, was measured using the ISEI of occupations (range 10 to 89) (27). This is a commonly used variable in research on occupational inequality. Respondents' occupational titles were first classified using the International Standard Classification of Occupations and subsequently converted to ISEI scores using a standardized crosswalk (28, 29). Often referred to as occupational “prestige” scores, the ISEI classification contains no value judgments, and merely provides an effective construct of the weighted sum of average education and average income of occupational groups.

Covariates of key predictors and the outcome variables are included as controls in predictive models in order to isolate associations most meaningfully. The set of control variables was defined after assessment of the correlation matrix (*SI Appendix, Fig. S7*). One matrix consists of socio-demographics (D): gender, age, age squared (to adjust for possible nonlinear effects), migration background, and marital status. A second matrix consists of indicators of labor market position and location (L): employment type, firm size, and urbanicity. All estimates are further adjusted for timing of the survey (T) through its week number. The significant associations between ISEI and mental health complaints persisted after further adjusting the prediction models of mental health indicators for respondents' history of depression or anxiety. Slight deviations from these matrices are indicated accordingly in *SI Appendix, Fig. S4*.

Mixed logits with country (j) random intercepts were fitted on individual-level data (i). Plotted estimates indicate the marginal effects (predicted probabilities) following social science convention (30). Prediction models for the COVID-19 economic hardship indicators and mental health indicators contain the following general functional form:

$$Y = \text{logit}(p)_{ij} = \beta_{0j} + X_{ij}\beta_1 + D_{ij}\gamma + L_{ij}\phi + T_{ij}\psi + \varepsilon_i.$$

Data Availability. The WageIndicator Survey of Living and Working in Coronavirus Times 2020 data are publicly available for noncommercial research purposes in the IZA Institute of Labor Economics Data Set Repository (31).

ACKNOWLEDGMENTS. This study was supported by the Postdoctoral Prize Fellowship of Nuffield College and the Beatrice and Samuel A. Seaver Foundation. We thank the reviewers for their insightful suggestions and the participants of the Nuffield College Sociology seminar for their feedback. We also thank Pablo de Pedraza (WageIndicator) for data acquisition guidance and Mandy van Leent for visualization design guidance.

1. R. Baldwin, E. Tumiura, “Thinking ahead about the trade impact of COVID-19” in *Economics in the Time of COVID-19*, R. Baldwin, B. Weder di Mauro, Eds. (CEPR Press, 2020), pp. 59–72.
2. World Trade Organization, Trade set to plunge as COVID-19 pandemic upends global economy. https://www.wto.org/english/news_e/pres20_e/pr855_e.htm. Accessed 15 May 2020.
3. D. Oesch, “Occupational structure and labor market change in Western Europe since 1990” in *The Politics of Advanced Capitalism*, P. Beramendi, S. Häusermann, H. Kitschelt, H. Kriesi, Eds. (Cambridge University Press, 2015), pp. 112–132.
4. Z. I. Santini *et al.*, Social disconnectedness, perceived isolation, and symptoms of depression and anxiety among older Americans (NSHAP): A longitudinal mediation analysis. *Lancet Public Health* **5**, e62–e70 (2020).
5. R. I. Schnitger, J. Wherton, D. Prendergast, B. A. Lawlor, Risk factors and mediating pathways of loneliness and social support in community-dwelling older adults. *Aging Ment. Health* **16**, 335–346 (2012).
6. S. P. Jenkins, A. Brandolini, J. Micklewright, B. Nolan, Eds., *The Great Recession and the Distribution of Household Income*, (Oxford University Press, 2013).
7. E. Saez, G. Zucman, Wealth inequality in the United States since 1939: Evidence from capitalized income tax data. *Q. J. Econ.* **131**, 519–578 (2016).
8. T. M. Smeeding, J. P. Thompson, A. Levanon, E. Burak, “Poverty and income inequality in the early stages of the great recession” in *The Great Recession*, D. B. Grusky, B. Western, C. Wimer, Eds. (Russell Sage, 2011), pp. 82–126.
9. A. V. Dorn, R. E. Cooney, M. L. Sabin, COVID-19 exacerbating inequalities in the US. *Lancet* **395**, 1243–1244 (2020).
10. S. A. Burgard, L. Kalousova, Effects of the Great Recession: Health and well-being. *Annu. Rev. Sociol.* **41**, 181–201 (2015).
11. D. Dooley, J. Fielding, L. Levi, Health and unemployment. *Annu. Rev. Public Health* **17**, 449–465 (1996).
12. S. Modrek, M. R. Cullen, Job insecurity during recessions: Effects on survivors' work stress. *BMC Public Health* **13**, 929 (2013).
13. J. E. Brand, The far-reaching impact of job loss and unemployment. *Annu. Rev. Sociol.* **41**, 359–375 (2015).
14. S. A. Burgard, J. E. Brand, J. S. House, Toward a better estimation of the effect of job loss on health. *J. Health Soc. Behav.* **48**, 369–384 (2007).
15. P. Bracke, V. van de Straat, S. Missinne, Education, mental health, and education-labor market misfit. *J. Health Soc. Behav.* **55**, 442–459 (2014).

16. D. De Moortel, O. Thévenon, H. De Witte, C. Vanroelen, Working hours mismatch, macroeconomic changes, and mental well-being in Europe. *J. Health Soc. Behav.* **58**, 217–231 (2017).
17. S. A. Burgard, L. Kalousova, K. S. Seefeldt, Perceived job insecurity and health: The Michigan Recession and Recovery Study. *J. Occup. Environ. Med.* **54**, 1101–1106 (2012).
18. Q. Chen et al., Mental health care for medical staff in China during the COVID-19 outbreak. *Lancet Psychiatry* **7**, e15–e16 (2020).
19. J. Peen, J. Dekker, Is urbanicity an environmental risk-factor for psychiatric disorders? *Lancet* **363**, 2012–2013 (2004).
20. L. Colodro-Conde et al., Association between population density and genetic risk for schizophrenia. *JAMA Psychiatry* **75**, 901–910 (2018).
21. A. Molarius et al., Mental health symptoms in relation to socio-economic conditions and lifestyle factors—A population-based study in Sweden. *BMC Public Health* **9**, 302 (2009).
22. Wage Indicator Foundation, WageIndicator survey of living and working in coronavirus times. <https://wageindicator.org/salary/living-and-working-in-times-of-the-coronavirus>. Accessed 1 May 2020.
23. S. Steinmetz, K. Tijdens, P. De Pedraza, Comparing different weighting procedures for volunteer web surveys: Lessons to be learned from German and Dutch WageIndicator data. <https://wageindicator.org/documents/publicationslist/publications-2009/0900-WP76-Steinmetz-Tijdens-Pedraza.pdf>. Accessed 3 May 2020.
24. M. Guzi, P. De Pedraza García, A web survey analysis of subjective well-being. *Int. J. Manpow.* **36**, 48–65 (2015).
25. Norwegian Centre for Research Data, European Social Survey Rounds 6, 8, 9 (2012, 2016, 2018). <https://www.europeansocialsurvey.org/data/download.html?r=9>. Accessed 1 May 2020.
26. European Centre for Disease Prevention and Control, Geographic distribution of COVID-19 cases worldwide. <https://www.ecdc.europa.eu/en/publications-data/download-todays-data-geographic-distribution-covid-19-cases-worldwide>. Accessed 30 May 2020.
27. H. B. Ganzeboom, P. M. De Graaf, D. J. Treiman, A standard international socio-economic index of occupational status. *Soc. Sci. Res.* **21**, 1–56 (1992).
28. International Labor Office, *International Standard Classification of Occupations ISCO-08: Structure, Group Definitions and Correspondence*, (ILO Publications, 2012), Vol. 1.
29. K. G. Tijdens, C. S. Kaandorp, Validating occupational coding indexes for use in multi-country surveys. *Survey Insights: Methods from the Field* (16 November 2018). <https://surveyinsights.org/?p=10422>. Accessed 3 May 2020.
30. C. Mood, Logistic regressions: Why we cannot do what we think we can do, and what we can do about it. *Eur. Sociol. Rev.* **26**, 67–82 (2010).
31. WageIndicator, WageIndicator Survey of Living and Working in Coronavirus Times 2020. IZA Institute of Labor Economics Data Set Repository. <https://datasets.iza.org/dataset/download/1388/wageindicator-survey-of-living-and-working-in-coronavirus-times-20205>. Accessed 1 May 2020.