How are adversities during COVID-19 affecting mental health? Differential associations for worries and experiences and implications for policy

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Abstract

**Background:** There are concerns that COVID-19 is having adverse effects on mental health. But it remains unclear whether this is being caused by worries over potential adversities due to the pandemic, or the toll of experiencing adverse events.

**Aims:** To explore the time-varying longitudinal relationship between (i) worries about adversity, and (ii) experience of adversity, and both anxiety and depression and test the moderating role of socio-economic position.

**Methods:** Data from 35,784 UK adults in the UCL COVID-19 Social Study (a panel study collecting data weekly during the Covid-19 pandemic) were analysed from 01/04/2020-28/04/2020. The sample was well-stratified and weighted to population proportions of gender, age, ethnicity, education and geographical location. Fixed effects regression was used to explore within-person variation over time.

**Results:** Cumulative number of worries and experience of adversities were both related to higher levels of anxiety and depression. Number of worries were associated more with anxiety than depression, but number of experiences were equally related to anxiety and depression. Individuals of lower socio-economic position were more negatively affected psychologically by adverse experiences.

**Conclusions:** Measures over the first few weeks of lockdown in the UK appear to have been insufficient at reassuring people given we are still seeing clear associations with poor mental health both for cumulative worries and also for a range of specific worries relating to finance, access to essentials, personal safety and COVID-19. Interventions are required that both seek to prevent adverse events (e.g. redundancies) and that reassure individuals and support adaptive coping strategies.

**Keywords**

Covid-19; mental health; anxiety; depression; pandemic; adversity; worries; stress
Introduction

The global pandemic of COVID-19 is leading to increasing experience of adversities, from infection and serious illness due to the virus, to financial shocks such as loss of employment and income, to challenges in accessing food, medication or accommodation, to adverse domestic experiences such as abuse. These experiences echo those reported during previous epidemics. However, their effects are causing even greater concern than in epidemics previously due to the global spread of the virus, the scale of lockdown measures that are proving necessary to contain the spread (which are having major effects on economies), and the long time-scale being projected for the pandemic.

In particular, there are concerns that COVID-19 will have substantial and lasting effects on mental health. Already, reports are emerging of a parallel epidemic of fear, anxiety and depression. But at present, it remains unclear what is triggering these adverse psychological effects: worries over potential adversities due to the virus, or the toll of actually experiencing adverse events. Literature suggests that experiencing adversities such as ill-health, financial problems, and challenges meeting basic needs is associated with poor psychological outcomes including anxiety, depression, post-traumatic stress, and broader distress. This has been found to apply to situations in epidemics too. However, it is not just experiencing adversities that can have such effects; even worries about experiencing adverse effects can negatively impact on mental health. For example, experiencing daily worries is associated with depressive symptoms both in the short-term and over several years. This has been shown for a range of worries, including those relating to health and finances. In fact, worries and other negative reactions to an event have in some instances been found to be more important in predicting mental health and wellbeing than experiencing the event itself. It is vital to ascertain whether it is worries of adversity or experiences of adversity that are most strongly linked to declines in mental health as each require different types of support or interventions to prevent or mitigate their effects. For example, if worries are most strongly associated with poor mental health, then provision of greater public reassurance or individual interventions such as online cognitive behavioural therapy programmes could be made more available to people. In contrast, if experience of adversity shows greater associations with poor mental health, then interventions that provide more tangible and material support (such as further financial relief measures) may be key.

Additionally, there are worries that adversities will exacerbate existing inequalities within societies by disproportionately affecting individuals of lower socio-economic position (SEP). These individuals are more likely to experience adverse events during the pandemic, as well as more likely to have poorer mental health in the first place. Low SEP individuals may also have fewer material and psychosocial resources available to deal with adversity, and studies specifically looking at the effect of adversity on mental health have shown that there is socio-economic variation in the consequences of adversity.

Therefore this study used a large, longitudinal dataset of weekly experiences during the early weeks of the lockdown due to COVID-19 in the UK to explore the time-varying longitudinal relationship between (i) worries about adversity, and (ii) experience of adversity, and both anxiety and depression. Further, it sought to ascertain whether the relationship between adversity and mental health was moderated by socio-economic position (SEP).
Methods

Participants
We use data from the COVID-19 Social Study; a large panel study of the psychological and social experiences of adults (aged 18+) in the UK during the COVID-19 pandemic. The study commenced on 21 March 2020 and involves online weekly data collection from participants for the duration of the pandemic in the UK. Recruitment into the study is ongoing. The study is not random but does contain a well-stratified sample. Participants were recruited using three primary approaches. First, snowballing was used, including promoting the study through existing networks and mailing lists (including large databases of adults who had previously consented to be involved in health research across the UK), print and digital media coverage, and social media. Second, more targeted recruitment was undertaken focusing on (i) individuals from a low-income background, (ii) individuals with no or few educational qualifications, and (iii) individuals who were unemployed. Third, the study was promoted via partnerships with third sector organisations to vulnerable groups, including adults with pre-existing mental health conditions, older adults, carers, and people experiencing domestic violence or abuse. The study was approved by the UCL Research Ethics Committee [12467/005] and all participants gave informed consent.

As questions asked about experiences of adversity in the last week, we focused on data 1st April 2020 (one week after lockdown commenced) to 28th April 2020, limiting our analysis to participants who were interviewed on two or more occasions during this period (n = 41,556, observations = 124,450). We used complete case data, excluding participants with complete data in fewer than two interviews (n = 5,772; 13.9% of eligible participants). This provided a final analytical sample of 35,784 participants (106,724 observations)

Measures

Depression
Depression during the past week was measured using the Patient Health Questionnaire (PHQ-9); a standard instrument for diagnosing depression in primary care. The questionnaire involves nine items, with 4-point responses ranging from “not at all” to “nearly every day”. We use the summed Likert score (range 0-27). Higher overall scores indicate more depressive symptoms.

Anxiety
Anxiety during the past week was measured using the Generalised Anxiety Disorder assessment (GAD-7); a well-validated tool used to screen and diagnose generalised anxiety disorder in clinical practice and research. There are 7 items, each with 4-point responses ranging from “not at all” to “nearly every day”. We use the summed Likert score in our analyses (range 0-21). Higher overall scores indicating more symptoms of anxiety.

Adversities
We study six categories of adversity: illness with COVID-19, financial difficulty, loss of paid work, difficulties acquiring medication, difficulties accessing food, and threats to personal safety.

Adversity experiences were measured weekly. Illness with COVID-19 was measured as diagnosed illness or experience of symptoms indicative of infection. Personal safety was measured as reporting being physically harmed or psychologically harmed by someone else on at least one day over the past week. Financial problems were measured as experiencing a major cut in household income (in a sensitivity analysis, we alternatively operationalised this as inability
to pay household bills), while loss of paid employment was measured as reporting having lost job or having been unable to do paid work. Inability to access sufficient food or required medication were measured using two self-report items. We constructed a weekly total adversity experiences measure by summing the number of adversities present in a given week (range 0-6). For adversities that were considered to be cumulative (i.e. once experienced in one week, their effects would likely last into future weeks), we counted them on subsequent waves after they had first occurred. This applied to experiencing suspected/diagnosed COVID-19, loss of paid work, major cut in household income, and harm.

Adversity worries were captured from two questions that asked participants to select which of a list of items had caused them (a) stress (however minor) in the past week, or (b) significant stress in the past week. Participants were prompted that “significant” stress could involve something being constantly on their mind or keeping them awake at night. We used the items "catching COVID-19", "your own safety/security", "finances", "losing your job/unemployment", "getting food", and "getting medication" as analogues to the adversity experiences described above. We constructed a weekly total worries measure by summing the number of items reported as worries in a given week (range 0-6). We considered each to be one-off events and counted them only in the weeks they were reported.

Socio-Economic Position

We measured SEP using five variables collected at baseline interview: annual household income (<£16,000, £16,000 - £30,000, £30,000-£60,000, £60,000-£90,000, £90,000+), highest qualification (GCSE or lower, A-Levels or vocational training, undergraduate degree, postgraduate degree), employment status (employed, inactive, and unemployed), housing tenure (own outright, own with mortgage, rent/live rent free), and household overcrowding (binary: >1 persons per room). From these variables, we constructed a Low SEP index measure by counting indications of low SEP (income <£16k, educational qualifications of GCSE or lower, unemployed, living in rented or rent free accommodation, and living in over-crowded accommodation), collapsing into 0, 1, and 2+ indications of low SEP to attain adequate sample sizes for each category.

Analysis

We used fixed-effects regression, which differs from other regression techniques as it explores within-person variation with individuals serving as their own reference point, compared with themselves over time. So all time-invariant (stable) covariates, are accounted for, even if unobserved. This approach is advantageous as individual stable characteristics such as socio-economic status, genetics, personality, history of mental illness and threshold for worries could confound associations between adversities and mental health. But as individuals are compared with themselves, such bias cannot affect results. Additionally, having experiences and worries varies over time, as does mental health, and both can be affected by time-varying confounders. Fixed-effects regression allows us to analyse these time-varying associations. So in this analysis we were able to assess the relationship between changes in both experiences and worries about adversity across several four weeks of data collection, with changes in mental health.

The basic model for mental health (MH) can be expressed as follows:

\[ MH_{it} = \beta_0 + \beta_1 E_{ikt} + \beta_2 W_{ikt} + \beta_3 D_t + \beta_4 N_t + \alpha_i + \epsilon_{it} \]

where \( MH_a \) is a measure of individual \( i \)'s anxiety and depression score at time \( t \), \( E \) is whether an individual \( i \) was experiencing adversity \( k \) at time \( t \), \( W \) is whether an individual \( i \) was worrying about adversity \( k \) at time \( t \), \( D_t \) is a vector of indicator variables for day, \( N_t \) is a continuous variable for days since lockdown, \( \alpha_i \) is unobserved time invariant
confounding factors, and $\varepsilon$ is error. Whether $E_{ikt}$ or $W_{ikt}$ were entered simultaneously or separately depends on the model.

Our analysis consisted of estimating several models. In Model 1, we regressed each mental health measure on the total number of adversity experiences and total number of adversity worries, both (a) separately and (b) jointly, using the fixed effects estimator to account for time-invariant heterogeneity across participants. In Model 2, we regressed each measure of mental health on adversity experiences and adversity worries separately for each category of adversity in turn. In Model 3, we repeated Model 1a including interactions between adversity measures and the low SEP index, in order to estimate differences in associations by SEP. We adjusted for day of week (categorical) and days since lockdown commenced (continuous) in each regression, and we standardised GAD-7 and PHQ-9 scores to aid comparison across the two measures. Other time-constant confounders were automatically adjusted for due to the analytical approach. To account for the non-random nature of the sample, all data were weighted to the proportions of gender, age, ethnicity, education and country of living obtained from the Office for National Statistics.

We carried out several sensitivity analyses to test the robustness of our results. First, we re-estimated Models 1 and 2 using inability to pay bills, rather than major cut in household income, as our measure of experienced financial adversity. Second, we repeated Models 1-3 using only reports of “significant stress” as opposed to minor stress to define the worries variables. Third, to assess whether our findings were just an artefact of our categorisation of SEP, we re-estimated Model 3 using a continuous measure of SEP derived from a confirmatory factor analysis (CFA) of the five SEP indicator variables. The CFA used weighted least square mean and given the discrete nature of the SEP indicators, the variance adjusted (WLSMV) estimator was implemented. The RMSEA of the CFA model was 0.08, indicating an adequate fit. We split the latent factor into quintiles using natural breaks in the factor values. All graphs show standardised coefficients (predicted change in standardised Likert scores). Analyses were carried out in Stata version 16.0 (Statacorps, Texas) and RStudio version 3.6.3.

Results

Descriptive statistics are shown in Table 1. There was within-variation in each of the measures, suggesting fixed effects was a valid approach. Table S1 in the supplementary material displays descriptive statistics for PHQ-9 and GAD-7 scores by SEP group. Our sample showed clear social gradients in anxiety and depression symptoms.

Table 1: Descriptive statistics, weighted figures.

| Outcome         | Overall Mean | Overall SD | Between SD | Within SD |
|-----------------|--------------|------------|------------|-----------|
| PHQ-9 Likert (range 0-27) | 6.29          | 5.93       | 5.65       | 1.80      |
| GAD-7 Likert (range 0-21)   | 4.83          | 5.27       | 5.01       | 1.63      |
| Experiences      |              |            |            |           |
| Total number of adversity experiences (range 0-6)| 0.58          | 0.82       | 0.78       | 0.26      |
| Lost work (binary) | 0.10          | 0.30       | 0.29       | 0.07      |
| Cut in income (binary)  | 0.19          | 0.39       | 0.37       | 0.11      |
| Unable to access sufficient food (binary) | 0.05          | 0.21       | 0.17       | 0.13      |
| Unable to access required medication (binary) | 0.03          | 0.17       | 0.17       | 0.10      |
| Suspected or diagnosed COVID-19 (binary) | 0.13          | 0.34       | 0.33       | 0.07      |
| Physically or psychologically harmed (binary) | 0.08          | 0.27       | 0.26       | 0.10      |
| Total number of adversity worries (range 0-6) | 1.37          | 1.35       | 1.20       | 0.62      |
| Losing job/unemployment (binary) | 0.13          | 0.34       | 0.29       | 0.17      |
| Variable                                | Overall Mean | Overall SD | Between SD | Within SD |
|----------------------------------------|--------------|------------|------------|-----------|
| Finances (binary)                      | 0.32         | 0.47       | 0.41       | 0.23      |
| Getting food (binary)                  | 0.23         | 0.42       | 0.34       | 0.25      |
| Getting medication (binary)            | 0.13         | 0.34       | 0.27       | 0.20      |
| Catching COVID-19 (binary)             | 0.43         | 0.49       | 0.41       | 0.27      |
| Personal safety (binary)               | 0.14         | 0.34       | 0.27       | 0.21      |

Both the total adversities and total worries indices were associated with increases in GAD-7 and PHQ-9 Likert scores (Figure 1). The inclusion of worries in the same model as experiences slightly reduced the effect size of experiences, although the inclusion of experiences in the model had little effect on the effect size of worries. Effect sizes for number of experienced adversities were similar across depression and anxiety measures, but adversity worries were more highly related to anxiety symptoms than depression symptoms.

![Figure 1: Associations between (i) total number of adversity experiences and (ii) total number of adversity worries and change over time in GAD-7 and PHQ-9 Likert scores derived from fixed effects models. “Experiences or worries” meant that experiences and worries were entered into separate models. “Experiences and worries” meant that experiences and worries were entered simultaneously into the same model, so were mutually adjusted for one another. Analyses were further adjusted for day of the week and time since lockdown began and automatically account for all time-constant confounders. Graphs show standardised coefficients.](image)

Figure 2 shows results from models with individual categories of adversity added to models in turn, with each adversity experience matched to the worry about that specific experience. Worries about all types of adversities showed associations with higher levels of GAD-7 and PHQ-9 scores. Experiences of adversities relating to accessing food, accessing medication, and personal safety were also associated with higher levels of GAD-7 and PHQ-9 scores. However, experience of adversities relating to employment and finance were not associated with changes in mental health, and experience of COVID-19 symptoms was only related to higher depression scores. Experience of harm was more strongly related to mental health than worry about personal safety.
Figure 2: Associations between (i) experience of specific types of adversities or (ii) worries about specific types of adversities and change over time in GAD-7 and PHQ-9 Likert scores derived from fixed effects models. Experiences and worries were entered simultaneously into the same model, so were mutually adjusted for one another. Analyses were further adjusted for day of the week and time since lockdown began and automatically account for all time-constant confounders. Graphs show standardised coefficients.

Associations according to SEP level are displayed in Figure 3. There was some evidence of a social gradient in the association between adversity experiences and adversity worries and mental health outcomes, with stronger associations found in more disadvantaged groups. However, individual estimates showed substantial variability, especially for experiences.

Figure 3: Associations between (i) total number of adversity experiences and (ii) total number of adversity worries and change over time in GAD-7 and PHQ-9 Likert scores derived from fixed effects models, by SEP index. Experiences and worries were entered simultaneously into the same model, so were mutually adjusted for one another. Analyses were further adjusted for day of the week and time since lockdown began and automatically account for all time-constant confounders. Graphs show standardised coefficients.
Sensitivity Analyses

The results from sensitivity analyses are displayed in the Supplementary Information. Point estimates suggest that inability to pay bills was more highly related to depression and anxiety symptoms than reporting a major cut in household income (Figure S1). The strength of the association between total number of adversity experiences and GAD-7 and PHQ-9 scores was also somewhat stronger using inability to pay bills rather than major cut in household income as the measure of financial adversity experience (Figure S2). Associations between adversity worries and mental health outcomes were stronger when using reported “significant” worries, with worries showing a larger relationship with anxiety than experiences (Figures S3 and S4). When looking at each adversity individually, estimated effects for “significant” worries typically exceeded those for adversity experiences, though associations between physical or psychological harm experiences were still larger than those for worries about personal safety. Using just significant adversity worries, the same social gradient was found for adversity experiences, but there was evidence of a reverse social gradient for the relationship between adversity worries and mental health, with largest associations found among the least disadvantaged groups (Figure S5).

When using the continuous measure of SEP derived from CFA, there was still some weak indication of a social gradient in the association between adversity experiences and mental health, and some indication of a reverse social gradient in adversity worries and anxiety symptoms, with smaller associations found in more disadvantaged groups (Figure S6 and Table S2).

Discussion

In this study, we explored the relationship between worries and experience of adversities and mental health during the first few weeks of the lockdown due to COVID-19 in the UK. Cumulative number of worries and experience of adversities were both related to higher levels of anxiety and depression. Number of worries were associated more strongly with anxiety than depression, but number of experiences were equally related to anxiety and depression. When considering specific types of adversities, there was greater variability in the relationship between experiences and mental health than worries and mental health. Worries were more strongly related to mental health than experiences for employment and finances, but less for personal safety and catching COVID-19. Individuals of lower SEP were more negatively affected psychologically by adverse experiences, but the relationship between worries, SEP and mental health was unclear.

Our findings that number of worries were more closely related to anxiety than to depression echoes previous research. Indeed, worrying is an integral component of many kinds of anxiety disorders. It is not surprising that results were even stronger for significant worries as this assessed worries that were constantly on one’s mind or that kept one awake at night, which describe processes of rumination associated with poor mental health in previous research. The finding that number of worries about adversities and number of experiences of adversity were equally related to anxiety echoes previous work highlighting how the impact worries about events can be equal to or even greater than experiences of events. The results on worries may indicate a bidirectional process between experiencing worries during COVID-19 and becoming more anxious. However, for depression there is less evidence of a bidirectional relationship in previous literature. Instead, reactivity to worries has been found to be a vulnerability factor for depression, but depression has not been found to predict higher negative reactivity.
In relation to experience of adversities, the fact that cumulative experiences was associated with poorer mental health but only certain specific experiences showed the same association suggests that it is the toll of cumulating events that is particularly challenging, perhaps as individual capabilities to manage challenging situations becomes exhausted. However, even when the findings here do not show an association between specific adversities and mental health, it does not necessarily imply that those adversities do not affect mental health. For example, when considering those relating to finance, adverse consequences for mental health may take time to arise, for instance as individuals encounter rejections during job searches or cuts in income begin to impact living standards. Indeed, a recent study found that unemployment becomes more highly related to feelings of sadness after 3 months of unemployment, suggesting a delayed response time for events. In line with this, it is notable that we found higher associations for the relationship between inability to pay bills and mental health than loss of income and mental health, suggesting the implications of losing money may be more important than losing money itself. Indeed, while loss of income could occur across the wealth spectrum, inability to pay bills is likely concentrated at those with lower levels of household income, so could be regarded as a more significant experience. Financial adversities may also have been anticipated, which may have decreased mental health in the lead up to the event, leading to a floor effect by the time the event occurred. Drops in household income may also have been offset by reductions in expenditure due to lockdown. But it is also possible that the fear of potential adversity, in particular given the low levels of control experienced in worrying, is psychologically more demanding than the adjustment after an adverse event has occurred. The exception to this theory on psychological demand is experiences of adversities relating to personal safety. These were much more strongly linked with mental health than worries about personal safety, and had the strongest link with mental health out of all adversities assessed, which echoes research on the strong negative mental health impact of domestic abuse and violence.

In relation to catching COVID-19, there was a relationship between worries about catching the virus and anxiety, but there was much greater variability in the relationship between actually catching the virus and mental health. It is possible that there was selection bias in the study, with only individuals who caught and recovered from COVID-19 continuing to take part. But it is also possible that in terms of anxiety, the experience of the virus was less bad than some people had been fearing, leading to relief that individuals had not experienced serious health consequences. Nevertheless, although the confidence intervals were wide, there was still evidence to suggest that catching COVID-19 was associated with increases in depression. This is interesting given evidence suggesting that COVID-19 leads to the release of pro-inflammatory cytokines associated with depressive disorders, and remains to be explored further in future research.

There was some slight evidence of a stronger relationship between adverse experiences and both anxiety and depression amongst people of low SEP. This echoes previous research suggesting that higher SEP can be a buffer against the effects of adversity, with individuals of lower SEP more vulnerable especially to economic shocks. But it is also of note that there was some evidence of a reverse social gradient for adversity worries (especially for more significant worries), with individuals of higher SEP more affected. This could suggest that people who usually face fewer adversities in day to day life, the experience of new worries relating to adversity may have more profound effects. Or it could reflect the already higher levels of anxiety and depression found amongst individuals of lower SEP, suggesting a ceiling effect in reactivity to stressful situations.

This study had a number of strengths including its large, well-stratified sample, which was weighted to population proportions for core socio-demographic characteristics. Further, the study collected data covering the entire period from the start of lockdown in the UK on a weekly basis, providing an extremely rich dataset with longitudinal data.
statistical approach (fixed effects regression) also allowed the comparison of individuals against themselves (within rather than between-subjects comparisons), so changes over time in the experience of worries and mental health were relative to each individual. As such, our measurement of worries was relative to each individual’s own perspectives, circumstances and coping threshold, allowing us to assess changes in an individual’s perception of their worries over time. Although, it should be noted that there were much wider confidence intervals measurements of association between experiences and mental health compared to worries and mental health, suggesting that people’s responses to experiences are much more variable, presumably due to differences in coping styles and wider circumstances. However, the study had several limitations. Our sampling was not random, so although we deliberately sampled from groups such as individuals of low SEP and individuals with existing mental illness, it is possible that more extreme experiences were not adequately captured in the study. It is also possible that individuals experiencing particularly extreme situations during the lockdown withdrew from the study. While our statistical method means their data is still included, we would lack longitudinal follow-up on their changing experiences. We also focused on just six types of adversities, including those relating to health, safety, finances and basic needs. However, many other types of adversity were not included in the study, including those relating to interpersonal relationships, displacement, and bereavement. Finally, our study only followed individuals up for a few weeks looking at the immediate associations with mental health. As such, it remains for future studies to assess how experience of adversities during the COVID-19 pandemic relates to long-term mental health consequences.

Overall, the finding that mental health was associated both with experiences and worries about adversities suggests that interventions are required that both seek to prevent adverse events (such as loss of jobs) but also that reassure individuals and support adaptive coping strategies. This appears to be particularly important for managing anxiety, where provision of online cognitive-behavioural training may help support individuals in the management of uncertainty. These results suggest that measures over the first few weeks of lockdown in the UK have been insufficient at reassuring people given we are still seeing clear associations with poor mental health both for cumulative worries and also for a range of specific worries relating to finance, access to essentials, personal safety and COVID-19. Given the challenges in providing mental health support to individuals during the lockdown, these findings highlight the importance of developing online and remote interventions that could provide such support, both as COVID-19 continues and in preparation for future pandemics.

**Statements**

**Declaration of interest**

All authors declare no conflicts of interest.

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**Author contribution**

LW, AS and DF conceived and designed the study. LW analysed the data and DF wrote the first draft. All authors provided critical revisions. All authors read and approved the submitted manuscript.

**Data availability**

Data used in this study will be made publicly available once the pandemic is over.

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