

Are adversities and worries during the COVID-19 pandemic related to sleep quality? Longitudinal analyses of 48,000 UK adults

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Abstract

There are concerns that both the experience of adversities during the COVID-19 pandemic and worries about experiencing adversities will have substantial and lasting effects on mental health. One pathway through which both experience of and worries about adversity may impact health is through effects on sleep. We used data from 48,723 UK adults in the COVID-19 Social Study assessed weekly from 01/04/2020-12/05/2020 to study the association between adversities and sleep quality. We studied six categories of adversity including both worries and experiences of: illness with COVID-19, financial difficulty, loss of paid work, difficulties acquiring medication, difficulties accessing food, and threats to personal safety. We used random-effect within-between models to account for all time-invariant confounders. Both the total number of adversity experiences and total number of adversity worries were associated with lower quality sleep. Each additional experience was associated with a 1.16 (95% CI = 1.10, 1.22) times higher odds of poor quality sleep while each additional worry was associated with a 1.20 (95% CI = 1.17, 1.22) times higher odds of poor quality sleep. When considering specific experiences and worries, all worries and experiences were significantly related to poorer quality sleep except experiences relating to employment and finances. Having a larger social network offered some buffering effects on associations but there was limited further evidence of moderation by social or psychiatric factors. Poor sleep may be a mechanism by which COVID-19 adversities are affecting mental health. This highlights the importance of interventions that support adaptive coping strategies during the pandemic.

Keywords

Covid-19; sleep; adversities; worries; stress; mental health

Background

The global pandemic of coronavirus disease 2019 (COVID-19) is leading to increasing experience of adversities. These adversities are both arising from the virus itself (i.e. infection, illness, and possibly death from the disease) and resulting from efforts to contain the disease, such as financial shocks following the loss of employment and income, challenges in accessing food, medication or accommodation, and adverse domestic experiences such as abuse¹⁻⁷. Similar experiences have been reported in previous epidemics⁸⁻¹⁵, but the scale of measures implemented and the long time-frames being projected for the COVID-19 pandemic are causing concern that we face manifold public health crises in the years to come^{2,16,17}.

In particular, there are concerns that adversity experiences will have substantial and lasting effects on physical and mental health^{17,18}. Studies suggest that intimate partner violence¹⁹ and socio-economic adversities such as poverty²⁰, job loss²¹, economic recession^{22,23}, and job insecurity²⁴, have lasting impacts on mortality and physical and mental health outcomes. Further, it is not just the experience of these stressors, but also worries about the potential experience of these stressors that can affect mental health, increasing levels of stress and affecting depression and wellbeing^{25,26}, as well as affecting physical health such as cardiovascular outcomes²⁷. This relationship between worries and experiences of adversities and mental health is already being demonstrated in studies during COVID-19²⁸.

One pathway through which both experience of and worries about adversity may impact health is through effects on sleep²⁹. Both worries about adversities and experience of adversities are types of stressors³⁰. The stress of experiencing adversities has been shown to impair sleep³¹⁻³³, while the stress of worrying about life events has been associated with shorter sleep length and greater sleep disturbance^{34,35}. Numerous biological studies have

focused on the pathways underlying these effects, including disruption of HPA axis activity and increased cortisol production, and bidirectional changes between hormonal variation and circadian rhythm^{36,37}. Inadequate sleep may reinforce the impact of stressors by reducing individual's ability to respond effectively, leading to a maladaptive psychophysiological cycle³⁸⁻⁴¹. Impaired sleep is in turn related to worsened physical health outcomes, such as cardiovascular disease, weight gain, and mortality^{42,43}, and mental health outcomes, such as anxiety and depression⁴⁴. It is therefore essential to understand whether experience of worries about adversities during the COVID-19 are leading to sleep problems.

While adversity may be related to poorer sleep quality on average, there are several factors that could protect against such effects. First, social support may buffer against stress through the provision of informational or tangible assistance or emotional support⁴⁵. A large body of literature shows that social support is associated with better sleep⁴⁶ and with improved physical and mental health outcomes, including lower mortality rates⁴⁷. Further, improved sleep has been identified as a pathway through which social support may affect health⁴⁸. However, decreased face-to-face contact and the increasing prevalence of adversity throughout populations may have reduced the availability and quality of social support during the pandemic⁷. Further, the novel nature of several adversities faced may have reduced the efficacy of informational or tangible assistance aspects of social support. Therefore, an unresolved question is whether social support buffers the association between adversity and sleep quality during lockdown.

A second factor that may be important for the link between adversity and sleep is existing mental health. Studies show that individuals with pre-existing mental health issues may be disproportionately affected psychologically by stressful events. For example, anxiety and depression can predispose individuals (especially men) to greater stress reactivity⁴⁹, while anxiety sensitivity can moderate the relationship between exposure to traumatic events and

post-traumatic stress⁵⁰. Further, in previous studies of epidemics, there has been some indication that pre-existing psychiatric conditions are a risk factor for poorer psychological outcomes⁸. However, when considering the link between psychological experiences and sleep, it is possible that individuals with existing mental health conditions may already have poorer sleep, leading to a ceiling effect, such that adversity may not have any further material detrimental effect on sleep^{38,51,52}.

To explore these issues further, the present study used data from a large, longitudinal study of the experiences of adults 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 quality of sleep. Further, it sought to ascertain whether the relationship between adversity and sleep quality was moderated by social support and existing mental health diagnoses.

Materials and Methods

Participants

We use data from the COVID-19 Social Study; a large panel study of the psychological and social experiences of over 50,000 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. The study protocol and user guide (which includes full details on recruitment, retention, data cleaning, weighting and sample demographics) are available at www.covidsocialstudy.org

Our questions asked about experiences of adversity in the last week, so we focused on data from 1st April 2020 (one week after lockdown commenced) to 12th May 2020, limiting our analysis to participants who were interviewed on two or more occasions during this period (n = 48,723, observations = 208,057; 80.2% of individuals interviewed between 1 April – 12 May). We used complete case data and excluded participants with complete data in fewer than two interviews (n = 2,439; 5% of eligible participants). This provided a final analytical sample of 46,284 participants (197,372 observations).

Measures

Adversities

We study six categories of adversity, each measured weekly (see Table 1). We constructed weekly total adversity worries and total adversity experiences measures by summing the number of adversities present in a given week (range 0-6). We considered worries to be one-off events and counted them only in the weeks they were reported. For adversities that are likely to be continuing (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 abuse victimisation.

Sleep

Sleep quality was elicited using a single item on sleep: “Over the past week, how has your sleep been?” with five response categories: very good, good, average, not good, very poor. To distinguish between minor variations in individual reporting and focus instead on levels of poor sleep quality that are likely to have larger consequences for health, we dichotomised this into a binary variable for not good or poor vs average or better sleep.

Social Support

We measured social support at first interview using four separate variables for *loneliness*, *perceived social support*, *social network size*, and *living alone*. Loneliness was measured using the 3-item UCLA-3 loneliness, a short form of the Revised UCLA Loneliness Scale (UCLA-R). Each item is rated with a 3-point rating scale, ranging from “never” to “often”, with higher scores indicating greater loneliness. We used the sum score measure (range 3-9).

Perceived social support was measured using an adapted version of the six-item short form of Perceived Social Support Questionnaire (F-SozU K-6). Each item is rated on a 5-point scale from “not true at all” to “very true”, with higher scores indicating higher levels of perceived social support. We used the sum score measure (range 6-30). Minor adaptations were made to the language in the scale to make it relevant to experiences during COVID-19 (see Supplementary Table S1 for a comparison of changes). *Social network size* was measured as number of close friends, with numbers capped at 10+. We included this as a continuous variable.

Psychiatric Illness

We defined psychiatric illness as reporting a clinically diagnosed mental health problem (“clinically-diagnosed depression”, “clinically-diagnosed anxiety”, or “another clinically-diagnosed mental health problem”) at first interview.

Analysis

We used random-effect within-between (REWB) models⁵³ (also known as hybrid models⁵⁴) to explore the association between within-person *change* in adversity experiences and adversity worries and the likelihood of poor quality sleep⁵⁴. Our basic model can be expressed as follows:

$$P(\text{Bad Sleep}_{it} = 1) \\ = \text{logit}^{-1}(\beta_{0t} + \beta_1 E_{ikt} + \beta_2 \bar{E}_{ik} + \beta_3 W_{ikt} + \beta_4 \bar{W}_{ik} + \beta_L X_t + \alpha_i + \varepsilon_{it})$$

where Bad Sleep_{it} is an indicator for whether individual i reported bad quality sleep at time t . \bar{E}_{ik} is the person-specific mean level of adversity experience k across time periods for individual i , while \bar{W}_{ik} is the corresponding figure for adversity worries. E_{ikt} and W_{ikt} are the deviations from the person-specific mean values of adversity experiences k and adversity worries k for individual i at time t . X_t is a vector of control variables defined below. α_i is the random intercept for individual i , which we model as distributed $\sim N(0, \sigma_\alpha^2)$. ε_{it} is the observation-specific residual error ($\sim N(0, \sigma_\varepsilon^2)$). We ran the models once with “adversity experiences” and “adversity worries” entered separately into the models, so as to ascertain if there was any initial association with sleep, and then re-ran the models with both sets of factors together, to see if results were maintained when mutually adjusting for one another.

Our interest was the sign and size of the coefficients, β_1 and β_3 , which represent the association between within-person change in adversity experiences and adversity worries and the likelihood of poor sleep. We focused on within-person change rather than cross-sectional variation as cross-sectional associations are likely to be confounded by factors such as socio-economic class or personality, which are related to the prevalence of adversity and to sleep. When looking at within-person changes, these characteristics should be fixed, and so

associations should not be biased due the influence of these omitted variables on sleep. In fact, in non-linear models such as the logistic model, the coefficients β_1 and β_3 are unbiased by time-invariant heterogeneity if the random intercept, α_i , is a linear function of the level-2 predictors. However, simulations have shown that the extent of bias due to violations of this assumption are limited in practice⁵³. Nevertheless, results can still be biased if exposure to new adversities or worries is related to other unobserved changes occurring for the individual.

We estimated several models. In Model 1, we regressed sleep quality 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. (Variance Inflation Factors suggest multicollinearity was not a problem in this model.) In Model 2, we regressed sleep quality on adversity experiences and adversity worries separately for each category of adversity in turn (finances, personal safety, etc.). In Model 3, we repeated Model 1a including interactions between adversity measures and each social support variable, for each social support variable in turn. In Model 4, we repeated Model 1a including interactions between adversity measures and baseline mental health. We adjusted for day of week (categorical) and days since lockdown commenced (continuous) in each regression (person-specific means and deviations from these means). 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 Statistics⁵⁵.

We carried out several sensitivity analyses to test the robustness of our results. First, we re-estimated Model 3 using inability to pay bills, rather than major cut in household income, as our measure of experienced financial adversity to differentiate between a change in wealth and a change in wealth that impacts on core financial activity. Second, we repeated each analysis using the sleep item as a continuous variable to test whether results were robust to variable measurement. For these regressions, we used the linear fixed effects estimator which

controls for time-invariant confounding by design. Third, we repeated regressions using both the linear probability fixed effect estimator and the fixed effects logit estimators. We did not use the fixed effects logit estimator in the main analysis as the estimator uses information from those whose sleep quality changes only, which may bias results towards those whose sleep is most responsive to adversity. Fourth, we repeated our main REWB model for the subset of individuals whose sleep quality changed and compared results against those from the fixed effect logit estimator to assess the possibility of confounding due to time invariant heterogeneity in our main analysis. Analyses were carried out in Stata version 16.0 (Statacorp, Texas) and R version 3.6.3.

Results

Demographics

Descriptive statistics for the exposures and outcomes are shown in **Error! Reference source not found.**2. There was within-variation in each of the measures, suggesting REWB was a valid approach. Tables S2 and S3 in the supplementary material displays descriptive statistics for baseline demographic, social support and mental health diagnosis variables. The weighted sample was 51.3% female, 9.6% from Black and minority ethnic backgrounds, and 19.0% of the sample were aged 18-34, 24.8% aged 35-49, 31.4% aged 50-64 and 24.8% aged 65 and above. Individuals with diagnosed mental illness or with lower social support had worse sleep, on average. Table S4 in the supplementary information displays the sample size by week of interview. Attrition was less than 10% each week.

Associations between adversities and sleep

Both the total number of adversity experiences and total number of adversity worries were associated with lower quality sleep (**Error! Reference source not found.**). The inclusion of

experiences and worries in the same model slightly reduced the effect size of experiences and had little effect on the effect size of worries. In models including both experiences and worries, each additional experience was associated with a 1.16 (95% CI = 1.10, 1.22) times higher odds of poor quality sleep while each additional worry was associated with a 1.20 (95% CI = 1.17, 1.22) times higher odds of poor quality sleep.

[FIGURE 1 HERE]

When considering specific experiences and worries, worries were significantly related to poorer quality sleep in every category of adversity (Figure 2). There was some heterogeneity in effect sizes, with the largest effects found for worries about personal safety (OR = 1.43 [1.35, 1.53]), followed by access to medication (OR=1.39 [1.30, 1.49]), employment (OR=1.25 [1.16, 1.35]), access to food (OR=1.24 [1.17, 1.32]), finances (OR=1.19 [1.12, 1.26]), and catching COVID-19 (OR=1.18 [1.12, 1.25]).

For experiences, the largest effects were found for access to medication (OR=1.42 [1.25, 1.61]) and difficulty in accessing food (OR=1.31 [1.17, 1.47]). Experiencing adversities relating to personal safety such as abuse were also related to poor quality sleep (OR=1.29 [1.14, 1.47]), as was catching COVID-19 (OR=1.30 [1.08, 1.54]) (although the confidence intervals were wide potentially indicating heterogeneity in responses). There was some evidence of a relationship between losing work and poor sleep (OR= 1.14 [0.95, 1.38]), but no evidence of a relationship with experiencing a cut in income (OR = 0.95 [0.84, 1.07]).

[FIGURE 2 HERE]

Moderators

There was little clear evidence that social support moderated the relationship between sleep quality and adversity experiences (Figure 3; see Table S5 in the supplementary information for interaction term coefficients). For adversity worries (Figure 3), there was evidence that the association between poor quality sleep and adversity worries was *weaker* among those with more close friends (OR = 0.97 [0.957, 0.99]). But for other measures, such as loneliness, associations were more tentative (Table S3).

There was also no evidence of differences in the relationship between worries and sleep quality in people with and without a diagnosed mental illness (Figure 4). There was limited evidence of moderation by mental health for adversity experiences, with larger effects found among those with diagnosed psychiatric conditions (OR = 1.10 [0.99, 1.24]).

[FIGURE 3 HERE]

[FIGURE 4 HERE]

Sensitivity Analysis

The results from sensitivity analyses are displayed in the Supplementary Information. Point estimates suggest that inability to pay bills was more highly related to poor sleep quality than reporting a major cut in household income (Figure S1).

Results using the fixed effects linear probability estimator were qualitatively similar to those from REWB models (Figures S2-S5). An increase in adversity experiences or adversity

worries was association with a ~2% point increase in the probability of poor sleep (Figure S2). Results using the fixed effects logit estimator, which, as noted above, only uses data from those whose sleep quality changed, were also qualitatively similar to those from REWB models, but produced stronger effect sizes (Figures S6-S9). An increase in adversity experiences or adversity worries was association with a ~ 4-5% point increase in the probability of poor sleep (Figure S6). Moderation analyses produced similar effect sizes to those from REWB models (Figures S8-S9 and Table S3). When limiting analyses to individuals whose sleep quality changed, similar results were produced by the REWB and fixed effects logit estimators (Figure S10), suggesting our main results are not biased due to time invariant heterogeneity.

When analysing sleep quality as a continuous measure, the main findings were qualitatively also similar, with both experiences and worries related to poorer sleep (Figure S11-14). However, there was no clear evidence of a moderating role of social support in the association between adversities experiences or worries and sleep (Figure S13). There was still a moderating role of mental health in the association between adversity experiences and sleep quality (Figure S14 and Table S3).

Discussion

In this study, we explored the relationship between worries and experience of adversities and quality of sleep during lockdown due to COVID-19. Cumulative number of worries and experience of adversities were both related to lower quality sleep. When considering specific types of adversities, all types of worries explored were associated with poorer sleep quality, while only specific experiences such as abuse, inability to pay bills, access food or medication, and catching COVID-19 showed clear associations with poorer sleep. Effect sizes were small: additional adversity experience or worries were related to approximately a

2% point higher likelihood of poor quality sleep, on average. Having more close friends helped to moderate the relationship between worries and sleep but there was weaker evidence that other social factors had any clear protective buffering effects.

This study supports findings from emerging research on COVID-19, which has suggested that sleep is being adversely affected amongst people during the pandemic⁵⁶. The clear relationship between both specific and cumulative worries and poor sleep echoes findings about the adverse effects of stress on sleep from a number of previous studies³¹⁻³³. However, it is notable that only specific experiences were related to poor sleep. These related specifically to difficulties in accessing food and medication, experience of abuse, and contracting COVID-19. In particular, experience of domestic violence has previously been well-researched in relation to sleep, with studies notably suggesting that fear of future abuse and nightmares can disrupt sleep⁵⁷. There has also been increasing research focus on the neuropsychiatric effects of coronavirus infections, with suggestions that sleep disturbance can follow from infection⁵⁸, which could explain the findings showing a relationship between having COVID-19 and impaired sleep. However, notably we didn't find a clear relationship between experiencing loss of work or cuts in household income and impaired sleep, although worry about these things was associated with poorer sleep. It is possible that consequences may take time to arise. For instance, loss of paid work or cuts in income may impact sleep only following repeated rejections during job search or when reduced incomes begin to impact living standards^{59,60}. Financial adversities may also have been anticipated such that effects were felt in anticipation of the financial adversities, and high strain work may itself have adversely impacted sleep³³. The effect of job loss on stress may also have been counterbalanced by increased leisure time⁶¹.

Our results also found only limited evidence of buffering of these associations by social factors. Having more close friends appeared to buffer the association between stressors and

sleep. This aligns with previous research on social support as a moderator of the relationship between occupational stress and sleep⁶², but is notable given that social contact with friends was not permitted limited during the period followed due to lockdowns. This suggests that potentially knowing that one has a circle of friends provides reassurance even if their support is not explicitly drawn on. However, for other social factors there was only limited evidence of any moderating effect. It is possible that decreased social interaction or limited face-to-face contact with social networks may have reduced any protective effects⁷. Further, it is interesting that there was only limited evidence of moderation by mental illness. Anxiety and depression can predispose individuals to greater stress reactivity⁴⁹, and our results suggested there could be slightly larger effects amongst those diagnosed psychiatric conditions. But results were not clear, and both those with and without psychiatric conditions are at risk of poor sleep as a result of adversities. This echoes other research showing how adversities and stresses are affecting not just those at high risk but broad populations⁷.

This study has 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. This data allowed us to estimate the relationship between adversity and change in sleep *within* individuals, rather than rely on cross-sectional variation, which would likely be confounded by time-invariant heterogeneity across individuals. However, the study has several limitations. First, we are unable to confirm causality. Whilst it appears logical that poor sleep itself cannot cause adverse experiences, there is likely a bidirectional relationship between worries and poor sleep, and worries may pre-date experiences. But our analyses suggest that both worries and experiences are independently associated with poor sleep. Additionally, we used a single item five-category self-report measure of sleep quality, which did not provide detail on which

aspect of sleep was most affected (e.g. duration, onset, interruption etc) and may have lacked sufficient variation and validity to accurately estimate effects. Indeed, self-reports of sleep have been found to be worse in psychiatric patients, which may also have biased responses⁶³. However, single item sleep scales have been shown to possess favourable measurement characteristics to lengthier sleep questionnaires and are widely used in research⁶⁴. It is possible that individuals experiencing worries or adversities may have perceived their sleep to be worse, but without substantial variation in the core qualitative parameters of sleep. Further, our sampling was not random. Although we deliberately sampled from groups such as individuals of low socio-economic position 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 individual 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. Social support was measured at first interview, which for many was after lockdown began. Responses to these questions could have been affected by adversities experienced already. 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 over a period of weeks. It remains for future studies to assess how experience of adversities during the COVID-19 pandemic relates to sleep – and to health – long-term.

Previous studies have shown that experience and worries about adversities during COVID-19 are associated with poorer mental health. The results presented here suggest that poor sleep may be a mechanism by which such adversities are affecting mental health. Worries about adversities were related to poorer quality sleep over time, as was cumulative load of adverse

experiences was also associated with poorer quality sleep. But only specific adversities such as those relating to personal safety, catching COVID-19, or challenges in accessing food and medication showed clear associations with poor sleep on their own. These results were relatively consistent amongst those with and without a diagnosed mental illness. Having a larger social network had some protective effects, but other social factors had more limited moderating effects on the relationship. These results may be generalisable to non-pandemic settings, showing how two different types of stressors (experiences and worries) are similarly related to sleep. Further, many of the measures of stressors we focused on (including both the worries about and experiences of adversities) can be experienced in daily life. However, the results also have an immediate relevance to supporting individuals during the current pandemic. They suggest the importance of interventions that seek to reassure individuals and enable adaptive coping strategies. 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.

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Figures

Figure 1: Associations (with 95% confidence intervals) between (i) change in total number of adversity experiences and (ii) total number of adversity worries and odds of bad quality sleep, derived from REWB models.

Note: Models either added experiences and worries separately or simultaneously (i.e. so mutually adjusted for one another). Analyses were further adjusted for day of the week and time since lockdown began.

Figure 2: Associations (with 95% confidence intervals) between (i) change in experience of specific types of adversities or (ii) worries about specific types of adversities and odds of poor sleep, derived from REWB models.

Note: Experiences and worries were entered into separate models, for each category of adversity in turn. Analyses were further adjusted for day of the week and time since lockdown began.

Figure 3: Associations (with 95 % confidence intervals) between (i) change in total number of adversity experiences and (ii) total number of adversity worries and odds of poor quality sleep according to (a) living arrangement, (b) social network size), (c) loneliness, and (d) perceived social support at baseline interview. Estimates are from REWB models, with experiences and worries entered into separate models. Analyses were further adjusted for day of the week and time since lockdown began.

Figure 4: Associations (with 95% confidence intervals) between (i) change in total number of adversity experiences and (ii) total number of adversity worries and odds of poor quality sleep according to mental health diagnosis at baseline interview.

Note: Estimates are from REWB models, with experiences and worries entered into separate models. Analyses were further adjusted for day of the week and time since lockdown began.

Tables

Table 1: Questions on adversities

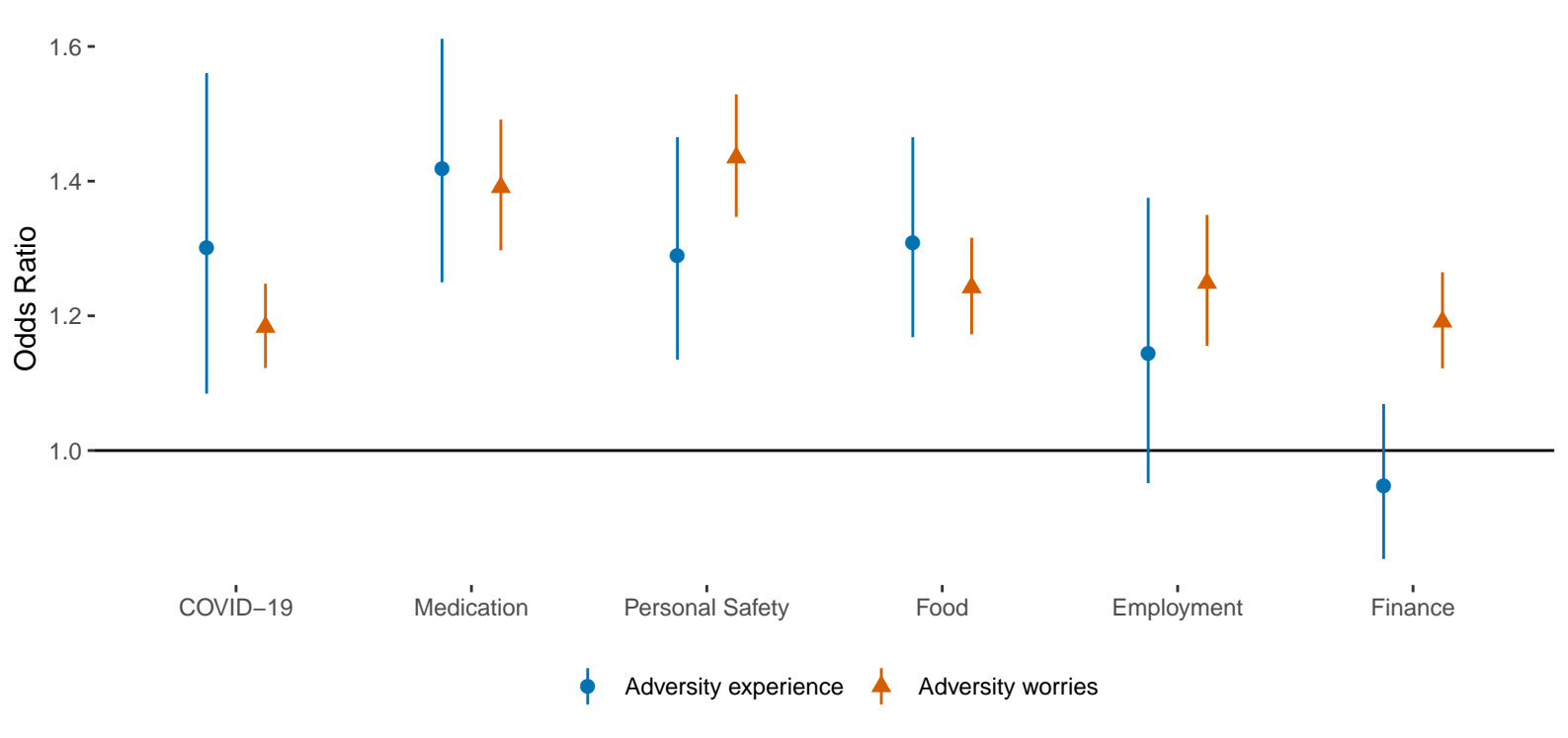
Type of adversity	Adversity worries	Adversity experiences
COVID-19 illness	Worried about catching COVID-19	Currently have or previously had suspected or diagnosed COVID-19
Financial difficulty	Worried about finances	Experienced a major cut in household income
Loss of paid work	Worried about losing your job/unemployment	Lost one's job or been unable to do paid work
Difficulties acquiring medication	Worried about getting food	Unable to access sufficient food
Difficulties accessing food	Worried about getting medication	Unable to access required medication
Threats to personal safety	Worried about personal safety/security	Experienced being physically harmed or hurt by somebody else or being bullied, controlled, intimidate or psychologically hurt by someone else

Table 2: Descriptive statistics, weighted figures.

Variable		Overall Mean	Overall SD	Between SD	Within SD
Sleep quality (range 1-5)		3.12	1.08	0.95	0.51
Bad Sleep (binary)		0.29	0.45	0.37	0.26
Experiences	Total number of adversity experiences (range 0-6)	0.59	0.84	0.79	0.28
	Lost work (binary)	0.10	0.30	0.29	0.08
	Cut in income (binary)	0.19	0.39	0.37	0.12
	Unable to access sufficient food (binary)	0.04	0.20	0.15	0.13

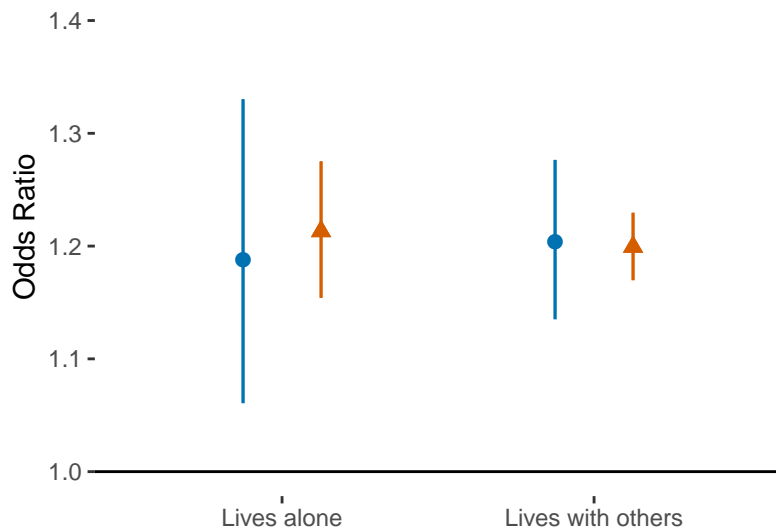
Variable		Overall Mean	Overall SD	Between SD	Within SD
	Unable to access required medication (binary)	0.03	0.16	0.12	0.11
	Suspected or diagnosed COVID-19 (binary)	0.13	0.34	0.33	0.08
	Physically or psychologically harmed (binary)	0.09	0.29	0.27	0.11
Worries	Total number of adversity worries (range 0-6)	1.30	1.32	1.15	0.66
	Losing job/unemployment (binary)	0.13	0.34	0.28	0.18
	Finances (binary)	0.31	0.46	0.39	0.24
	Getting food (binary)	0.20	0.40	0.30	0.26
	Getting medication (binary)	0.12	0.32	0.25	0.20
	Catching COVID-19 (binary)	0.42	0.49	0.40	0.29
	Personal safety (binary)	0.13	0.34	0.26	0.22

* Between SD is the standard deviation in participants' average responses. Within SD is the standard deviations in an individual's report, averaged across participants.

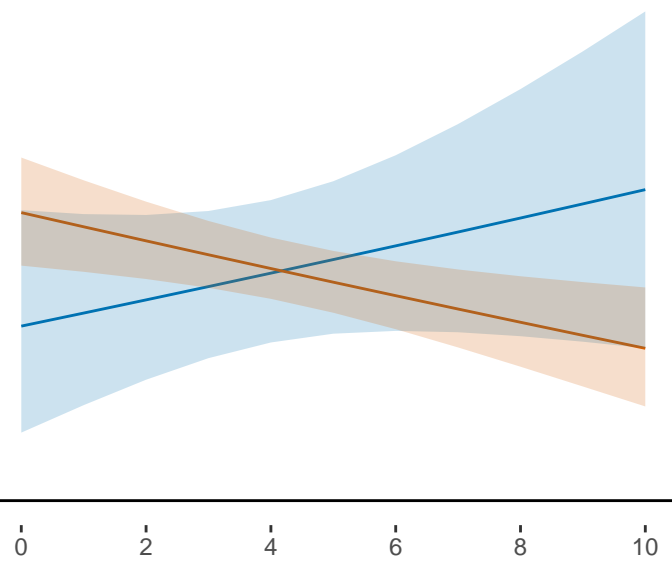


a

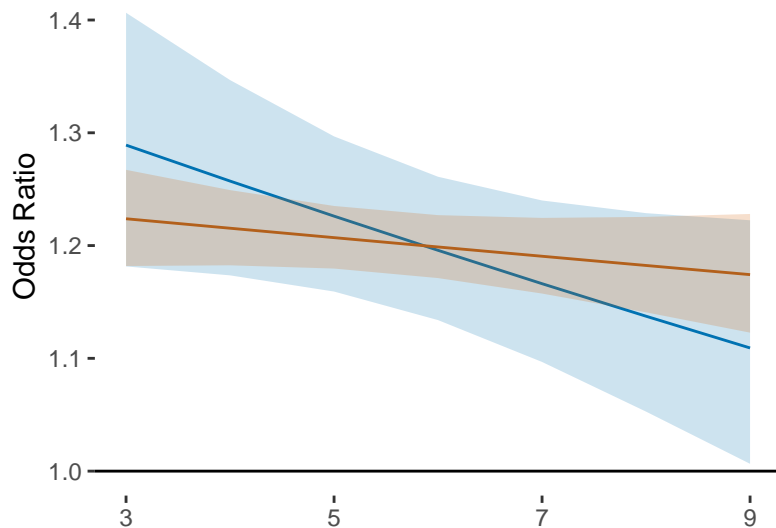
Living Arrangement

**b**

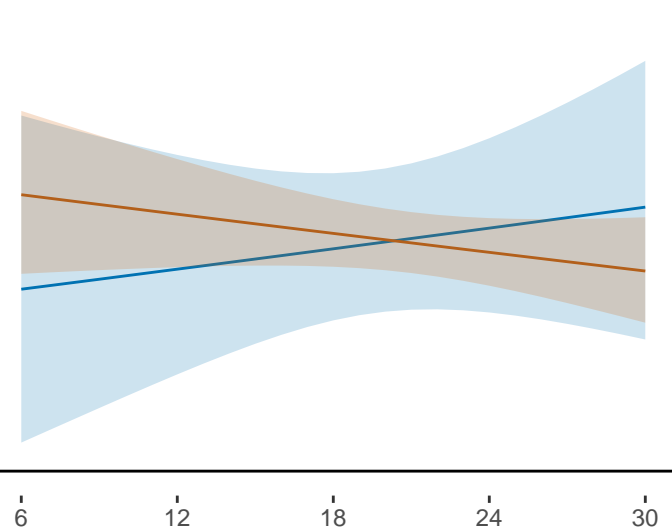
Number of close friends

**c**

UCLA Loneliness

**d**

Social Support (F-SozU K-6)



● Adversity experience ▲ Adversity worries

