The Covid-19 pandemic and its impact on socioeconomic inequality in psychological distress in the UK: an update[1]

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Abstract

This paper extends the earlier work of Davillas and Jones (2021) on socioeconomic inequality in mental health, measured by the General Health Questionnaire (GHQ), to include the second national lockdown up to March 2021.

Keywords: COVID-19; health equity; socioeconomic inequality; GHQ; mental health; psychological distress.
JEL codes: C1, D63, I12, I14.

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1 Introduction

Understanding Society, the UK Household Longitudinal Study (UKHLS), tracked its participants with web-based Covid-19 Surveys during the first two waves of the pandemic, between April 2020 and March 2021. This paper addresses socioeconomic inequality in mental health, measured by the General Health Questionnaire (GHQ), and extends the work of Davillas and Jones (2021) that presented results for the first wave of Covid in the UK between April and July 2020. The contribution of this short paper is to extend the span of the UKHLS Covid-19 Survey data to include all survey waves. This allows us to follow the progress of the UK population's mental wellbeing during the easing of the first national lockdown, the period of limited restrictions during the summer of 2020 and the second national lockdown up to March 2021[3].

After the outbreak of Covid-19 there was a substantial deterioration in population mental wellbeing and the prevalence of mental health symptoms increased (e.g., Aknin et al., 2021; Banks and Xu, 2020; Robinson et al., 2022). The experience of mental health problems is disproportionate across groups, by gender, age, race and socioeconomic status. Groups with disadvantaged backgrounds such as lower socioeconomic positions and pre-existing psychological distress were more likely to experience adversities including job loss and financial stress, and difficulties accessing basic requirements like food and medical care (Brodeur et al., 2021; Pierre et al., 2021).

During the lockdown, the worsening of women's mental health was much greater than the population average, compared to the pre-pandemic level (Aknin et al., 2021; Banks and Xu, 2020). The decline of mental health among women has been twice as large as among men after the onset of the pandemic (Etheridge and Spantig, 2020). Researchers who reported a gender gap have also noticed that the age disparity has widened with the impact of Covid-19. Generally, younger age groups have been affected more than older age groups. Age groups below 35 had a larger decline in mental health after the onset of the pandemic (Aknin et al., 2021; Banks and Xu, 2020). In particular, young women were strongly affected by the pandemic (Etheridge and Spantig, 2020). Mental distress during the pandemic also varied by ethnicity (Proto and

[3] Table A.1 in the Online Appendix provides a detailed timeline.

Quintana-Domeque, 2021).

Loss of income and unemployment were associated with anxiety, depression and poor mental health outcomes during the Covid-19 lockdown (Di Gessa et al., 2021; Shevlin et al., 2020). But Johnston (2020) found that financial factors had no significant effects on rebounds in mental health but that strong self-efficacy could help with the resilience of mental health during the lockdown. Health conditions and behaviours, such as substance misuse (smoking, drinking, drug abuse), physical disability (Steptoe and Di Gessa, 2021) and chronic medical conditions (Chen and Wang, 2021; Davillas and Jones, 2021) also relate to mental wellbeing.

2 Data

Our sample design extends Davillas and Jones (2021) and is summarized in Figure 1. The data come from Understanding Society (UKHLS); a nationally representative longitudinal study of UK households that has been released annually since the first wave in 2009-10. As socioeconomic circumstances are predetermined, variables from Waves 1-8 of the UKHLS, prior to the pandemic, provide the measures of time-invariant circumstances[4]. The baseline for mental health outcomes is GHQ measures in two pre-pandemic surveys: the UKHLS Wave 9 and the 2019 Interim Wave[5]. The 2019 Wave is an interim release of information covering participants in UKHLS Waves 10 and 11 interviews and provides a reference for data collected in the Covid-19 surveys. The UKHLS Covid-19 Surveys collected data across the first two waves of the Covid-19 pandemic in the UK, between April 2020 and July 2020 and bi-monthly afterwards, (Institute for Social and Economic Research, 2021). The study design uses the maximum of the observed sample at each wave rather than following a balanced sample of individuals[6]. The final sample consists of 8317 respondents. We use the UKHLS official cross-sectional survey weights for Wave 9 and 2019 Interim Wave. Given differences in response rates in the subsequent waves of the Covid-19 survey, following Davillas and Jones (2021), we construct our own set of longitudinal

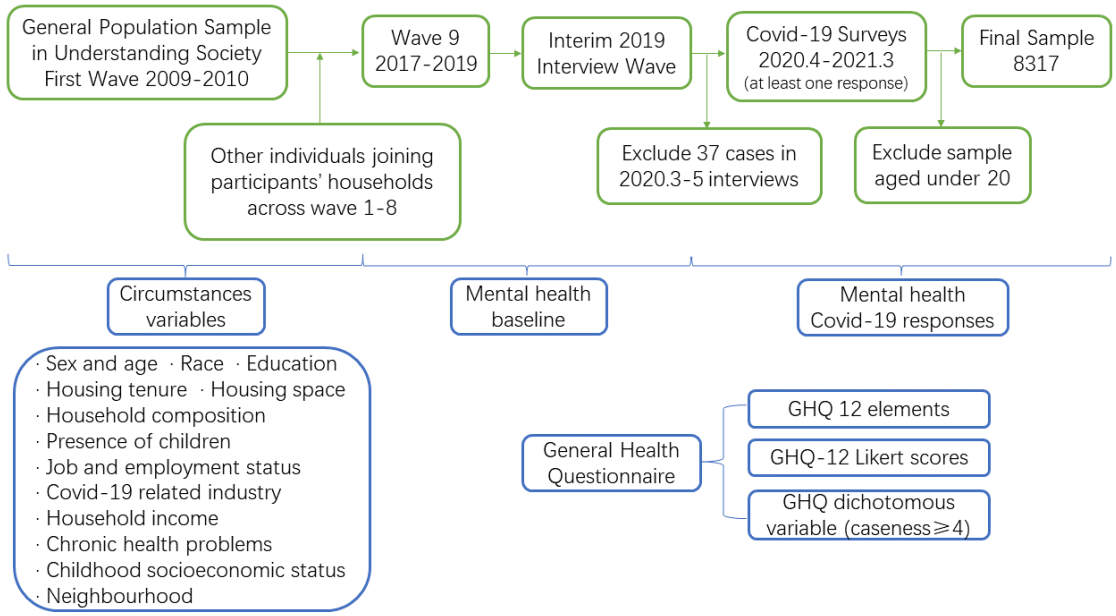
[4] Summary statistics for the circumstances are available in Table A.2 in the Online Appendix.

[5] The twelve questions in the GHQ questionnaire in these Covid-19 surveys are identical to the previous surveys at Wave 9 and the Interim Wave in 2019.

[6] As we maximize the sample size at each wave, the total sample is extended compared to the previous work, which explains the limited differences from the original results (Davillas and Jones, 2021) in the waves before July 2020.

weights to adjust for non-response for each of the Covid-19 Waves. Specifically, we conducted a stepwise probit model as a function of the circumstance variables to predict the responding probability in each of the Covid-19 Waves. These predicted probabilities provide inverse probability weights that are used to adjust the Wave 9 base weights and provide the weights used for the Covid-19 Survey waves. This gives eight sets of longitudinal weights for each of the Covid-19 Waves. As a robustness check, we have compared weighted and unweighted analyses to assess the influence of unequal selection and non-response on the analysis of socioeconomic inequality.

Figure 1: Design of sample data and corresponding variables



The GHQ questionnaire is used to measure the mental wellbeing of the general population across Wave 9, the Interim 2019 Wave and the Covid-19 waves[7]. We use a Likert-scaled GHQ-12 score, caseness scores for each

[7] GHQ spans 12 dimensions: concentration, loss of sleep, playing a useful role, ability to make decisions, coping under the stain, overcoming difficulties, enjoying activities, facing problems, depression and unhappiness, confidence, feeling worthless and general happiness. There is a four-category scale ranging from "not at all" (0), "no more than usual" (1), "rather more than usual" (2) to "much more than usual" (3). Caseness scoring defines that the first two levels represent better mental health, coded as 0, and the latter two denote distressed states, coded as 1. In addition, we also used a combined GHQ-12 index based on the caseness score. The threshold of caseness scoring GHQ-12 index is defined to be 4. Thus, caseness GHQ-12 higher than this threshold implies worse mental conditions.

dimension of GHQ, and a combined GHQ-12 caseness index to analyse the socioeconomic inequalities in psychological distress before and during the pandemic. The choice of predetermined circumstance variables follows Davillas and Jones (2021), based on ethical judgements and potential sources of mental health inequality in the context of the policy response to the pandemic.

3 Methods

Following Davillas and Jones (2021), measurement of socioeconomic inequality is based on the distribution of mean health outcomes conditional on observed circumstances. This uses parametric predictions from reduced form regressions of the mental health outcomes regressed on the observed circumstance variables. We present the results for three types of mental health outcomes, all derived from the GHQ, and compare the measures in UKHLS Wave 9, Interim 2019 Wave and the subsequent Covid-19 web-based surveys.

For the GHQ-12 Likert score we use the variance to measure both the total inequality in GHQ-12 Likert score, based on actual outcomes, and the inequality that is explained by socioeconomic circumstances, based on the predicted outcomes. For the binary indicators for each of the twelve elements in GHQ questionnaire and for the dichotomized overall GHQ-12 index, we use a dissimilarity index, index to measure $I(.) = \frac{2}{n\bar{h}}\sum_{i=1}^{n}\left|\widetilde{h_i} - \bar{h}\right|$ where the predicted outcome $\widetilde{h_i}$ is estimated by probit models.

To analyse the contribution of circumstances to socioeconomic inequality, we apply a Shapley-Shorrocks decomposition. This divides the observed socioeconomic inequality into the relative contributions from each group of circumstance factors (Juárez and Soloaga, 2014; Davillas and Jones, 2021).

4 Results

Figure 2 and Table A.3 in the Online Appendix present the mean values of the GHQ outcomes for each wave of the data, with tests for the comparison of each wave with the baseline results from the 2019 Wave. There were significant declines in overall mental health following the onset and the re-emergence of the Covid-19 pandemic from April 2020 to March 2021,

compared to the 2019 Wave. Although there was some recovery of mental health in July and Sept 2020, the aggregated GHQ Likert scores and caseness scores (caseness≥4) remained significantly higher than the pre-pandemic 2019 Wave throughout the pandemic. The most affected individual item was the enjoyment of daily activities. In the first wave of Covid, other strongly affected symptoms are playing a useful role, concentration and unhappiness. In the second wave, the highly affected items related to decision-making (in September 2020), depression, unhappiness and concentration (in November 2020). The substantial decreases in mental wellbeing in the Covid-19 surveys show that the pandemic had a prolonged detrimental influence on population mental health.

Insert Figure 2 around here

Table 1 presents the results for total absolute inequality, measured by the variance, for the observed GHQ outcomes in each wave of the data. Comparison of Wave 9 and the 2019 Wave shows that the total inequality was relatively stable before the Covid-19 crisis. The new data shows that, as in the first wave, inequality in population mental health was also systematically and significantly higher in the second wave of the pandemic.

Insert Table 1 around here

In contrast to Table 1, which shows total inequality, Tables 2 and 3 present relative socioeconomic inequality. Table 2 shows that the dissimilarity indices for the overall caseness measure and reveals that, during both waves of the pandemic wave socioeconomic inequality in caseness fell to 20% compared to nearly 25% before the pandemic[8]. Table 3 presents the variance share for our composite GHQ-12 Likert measure. Before the pandemic, the fraction of total inequality attributed to observed socioeconomic inequality was statistically significantly at a level of about 12%. This proportion fell to 11.14% with the first wave of the pandemic and increased to the previous level, at about 12%,

[8] Table A.4 in the Online Appendix shows the results for socioeconomic inequality measured by the dissimilarity index for each element of GHQ. The baseline results are similar before the pandemic with no statistically significant differences. Except for strain, sleep, confidence and facing up to problems ($p>0.05$), the dissimilarity indices for the other items reduced in significantly during period of the Covid-19 pandemic. The most affected dissimilarity index, enjoying normal activities significantly reduced to 0.086 in April 2020 and 0.103 in November 2020, with a slight increase to 0.154 during the first easing of the lockdown (still lower than the baseline).

in May and June 2020. From July 2020, the variance shares stayed at the lower level of about 11% until March 2021. To understand these findings, note that the absolute total inequality, measured by the variance of the GHQ-12 Likert, increased markedly during the periods of lockdown, while the absolute level of explained inequality remained relatively stable and the relative socioeconomic inequality did not increase during the peak periods of the pandemic[9].

Insert Table 2 around here

Insert Table 3 around here

Figures 3 and 4 display the Shapley-Shorrocks decomposition results for the variance share for GHQ-12 Likert scores and for dissimilarity indices for the dichotomous mental distress indicators; the colours indicate the broad categories of variables which remain constant over time[10]. Before the pandemic, chronic conditions and housing conditions explain most of the socioeconomic inequality in both outcomes. In contrast, at the two peaks of Covid-19, in April-May 2020 and November 2020-January 2021, demographics and chronic conditions are the first and the second highest sources of the socioeconomic inequalities. During the pandemic, housing conditions and employment status were the third and fourth factors.

[9] This is illustrated by Figure A.1 in the Online Appendix.

[10] These results are tabulated in Tables A.5 and A.6 in the Online Appendix.

Figure 3: Decomposition analysis of GHQ-12 Likert scores

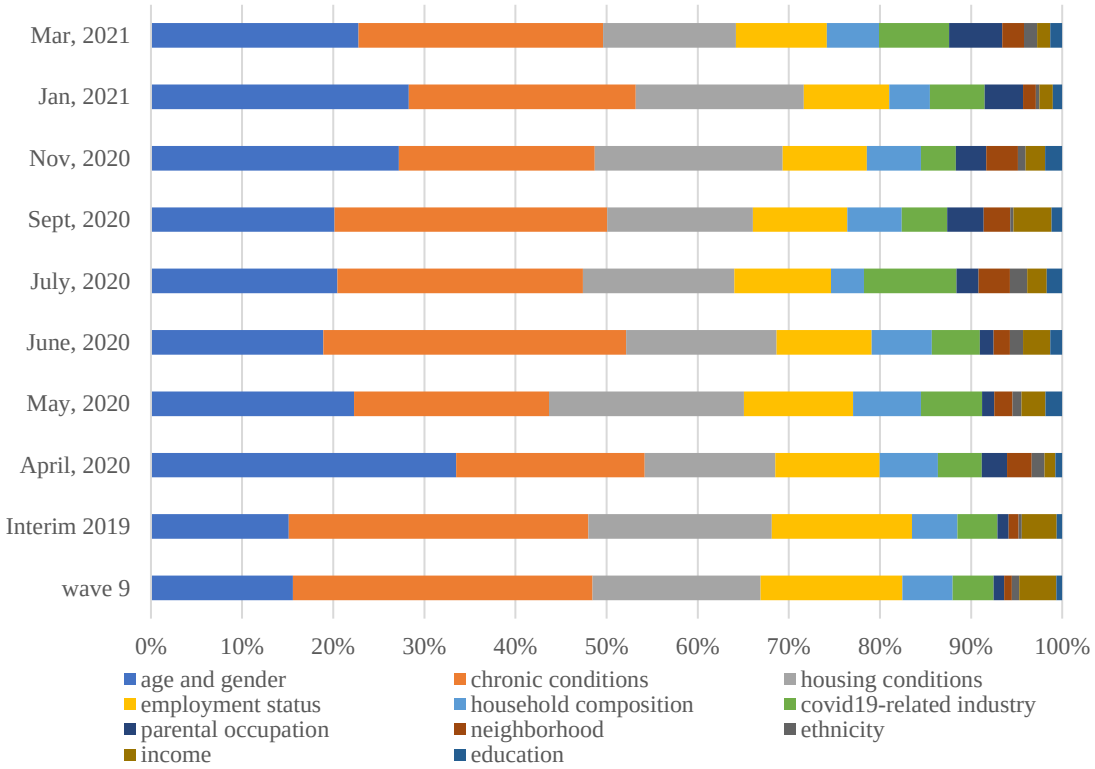
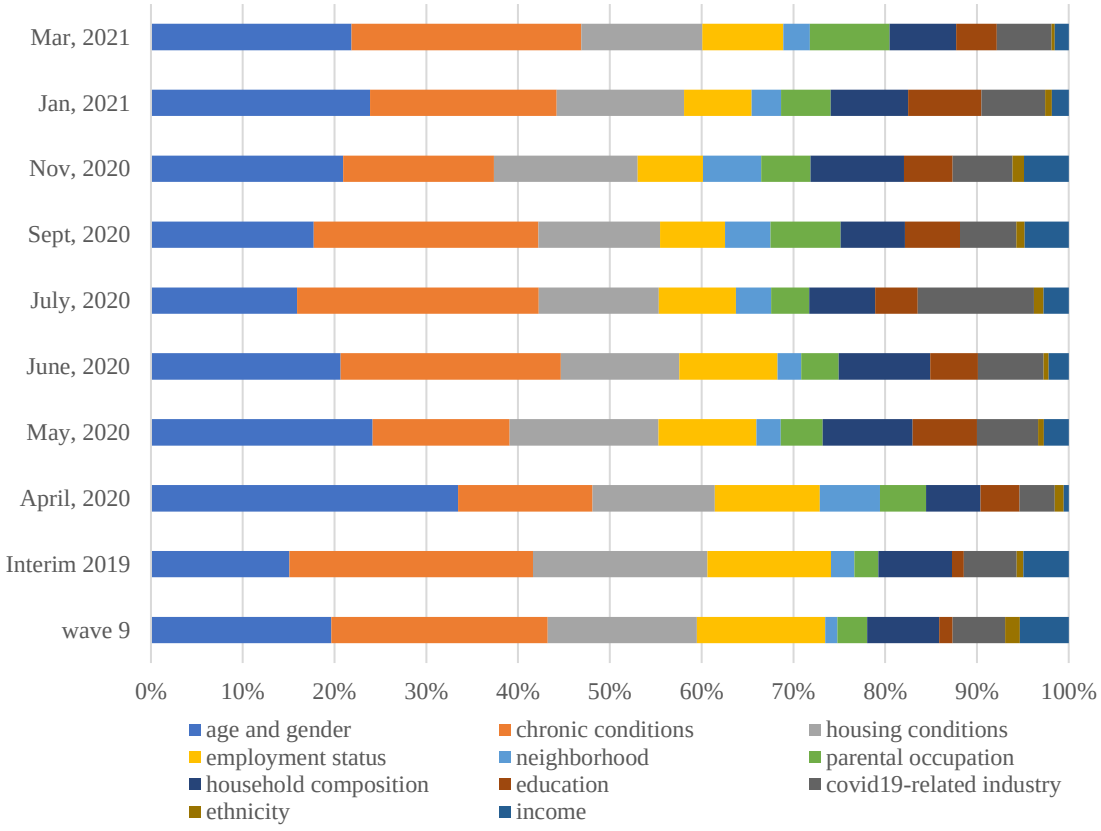


Figure 4: Decomposition analysis of GHQ dichotomous caseness ≥4



5 Discussion

Previous research has reported that the mental health worsened after the outbreak of the pandemic (Aknin et al., 2021; Banks and Xu, 2020; Daly et al., 2020; Davillas and Jones, 2021; Robinson et al., 2022; Zamarro, 2021). Similarly, we observe substantial increases in the average GHQ Likert scores in two Covid-19 peaks and similar fluctuations in mean values as the pandemic progressed. There were also increases in the proportion of people reporting psychological distress, and the most affected item was being unable to enjoy daily activities, coinciding with evidence from the first wave in Johnston (2020). In comparison to the first wave of the pandemic, we observe higher average GHQ-12 Likert scores and more items with significantly increased proportions in psychological distress in the second wave of the pandemic[11]. More people reported being unhappy and depressed in the second lockdown period than worrying about playing a useful role, which was one of the most affected items in the first wave of the pandemic (Davillas and Jones, 2021; Johnston, 2020). The results suggest that population mental wellbeing could have a prolonged negative response if there were to be repeated outbreaks of the pandemic in the longer term.

We also observe significant increases of variance, measuring overall inequality in GHQ-12 Likert scores in the waves of the pandemic, implying a widening of total inequality in mental health in the population during the periods of lockdown. Conversely, there were significant decreases of relative inequality, measured by the variance share, and declines in the socioeconomic inequality measured by dissimilarity indexes for each item and for overall binary variable (caseness≥4) in the first two Covid-19 waves. Thus, there have been other factors associated with the amplification of mental health inequality beyond the observed demographics and socioeconomic factors that we use as predetermined circumstances. These factors may include: the direct exposure to Covid-19, exposure among family and friends, and the responsibility for caring for others; indirect consequences of Covid-19 on economic security through job loss, forced absence from work and the ease of working from home, the impact of shielding and other factors associated with social isolation and loneliness, differences in the burden of home schooling

[11] Other factors, such as the ongoing transition to Brexit in the UK, may influence the underlying trend in psychological distress but it is notable how the outcomes track the waves of the pandemic and associated lockdowns and that similar evidence has been reported from other countries in Europe and North America (Aknin et al., 2021; Robinson et al., 2022).

and housework; with all of these mediated by heterogeneity in trust and social capital, prosocial attitudes and behaviour, personality traits and individual resilience (Aknin et al., 2021, Brodeur et al., 2021).

During the first two lockdowns, demographic factors contributed most to the explained inequality during the pandemic. The regression results show that younger women (aged 20-34) suffered most in all age and gender groups, and older men (aged 65+) were the least distressed group. This is consistent with reports focusing on gender and age gaps, that report that younger groups and women have been more vulnerable during the pandemic (Aknin et al., 2021; Banks and Xu, 2020; Etheridge and Spantig, 2020). As these groups also had relatively lower mental wellbeing prior the pandemic (Di Gessa et al., 2021), the pandemic has widened the gaps between women and men, young and old (Etheridge and Spantig, 2020).

During the lockdowns, housing conditions became more important for mental wellbeing, perhaps because most daily activities were limited in the house including childcare, home-schooling (Cheng, 2021), distance working and self-quarantines. Household composition also had increasing contributions to the total inequality with the progress of the lockdowns. This might relate to the loneliness of self-isolation conditions without adequate social networks and anxiety about higher risks of transmission in multi-occupancy households (Davillas and Jones, 2021; Haroon, et al., 2020) or the potential support in childcare in multi-generation households (Cheng, 2021). Employment status accounts for around 10% of the explained inequalities. Stable employment might help face the uncertainty and play a social role during lockdown, which also implies the importance of policy support in the labour market such as the furlough scheme. People with chronic diseases were relatively vulnerable as this group contributes around 30% of explained mental inequality, just behind demographic elements and contributed most in the period between the two pandemic waves.

Compared to the first wave of COVID-19 our new findings for the second wave echo those of Davillas and Jones (2021). The second wave was associated with an increase in the prevalence and variability of psychological distress while the variation explained by pre-existing social circumstances remained constant in absolute terms and declined in relative terms.

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Figure 2: Mean values for the GHQ outcomes

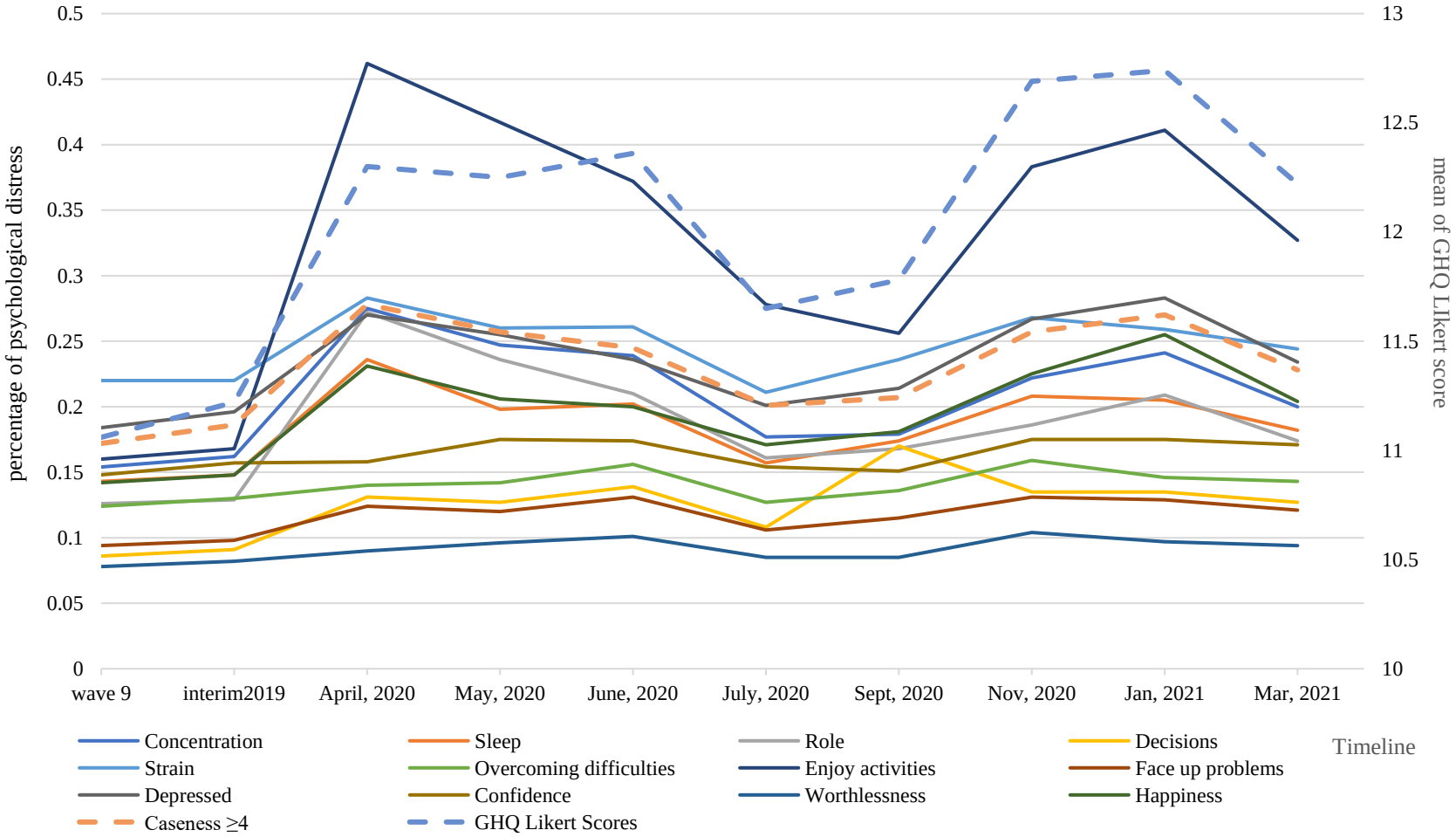

Table 1: Measures of total inequality of the General Health Questionnaire (GHQ) Likert scores

	Wave 9	Interim 2019	April 2020	May 2020	June 2020	July 2020	Sept 2020	Nov 2020	Jan 2021	Mar 2021
Variance	29.30***	29.64***	35.58***	35.21***	37.36***	31.68***	31.50***	35.96***	35.50***	33.98***
Difference p-value#	0.752	-	**0.000**	**0.000**	**0.000**	0.082	0.132	**0.000**	**0.000**	**0.000**

Notes: Results in the first two columns use the UK Household Longitudinal Study sample weights and those in the third-tenth columns are weighted by our own longitudinal weights. Bootstrapped standard errors (500 replications) are used for inference.

*** $p < 0.01$ (for the Ho hypothesis that total inequality is equal to 0).

#Test for differences in the inequality measures compared to the corresponding results for the Interim 2019 Wave; bootstrapped p-values using 500 replications. The bold values are statistically significant at $p < 0.05$.

Table 2: Measures of socioeconomic inequality of the GHQ-12 dichotomous caseness≥4

	Wave 9	Interim 2019	April 2020	May 2020	June 2020	July 2020	Sept 2020	Nov 2020	Jan 2021	Mar 2021
Dissimilarity index θ_I	0.262*** (0.010)	0.239*** (0.010)	0.202*** (0.012)	0.211*** (0.012)	0.210*** (0.012)	0.227*** (0.011)	0.232*** (0.012)	0.199*** (0.014)	0.197*** (0.014)	0.205*** (0.011)
Difference p-value#	0.099	-	**0.005**	**0.034**	**0.031**	0.427	0.648	**0.004**	**0.002**	**0.017**

Notes: Results in the first two columns use the UK Household Longitudinal Study sample weights and those in the third-tenth columns are weighted by our own longitudinal weights. Bootstrapped standard errors for the inequality measures in parenthesis (500 replications) are used for inference.

*** $p < 0.01$ (for the Ho hypothesis that the dissimilarity index is equal to 0).

#Test for differences in the inequality measures compared to the corresponding results for the Interim 2019 Wave; bootstrapped p-values using 500 replications. The bold values are statistically significant at $p < 0.05$.

Table 3: Measures of relative socioeconomic inequality for GHQ-12 Likert scores

	Wave 9	**Interim 2019**	**April 2020**	**May 2020**	**June 2020**	**July 2020**	**Sept 2020**	**Nov 2020**	**Jan 2021**	**Mar 2021**
Relative inequality: variance share θs	12.02*** (0.407)	12.66*** (0.446)	11.14*** (0.359)	12.32*** (0.435)	12.23*** (0.434)	10.88*** (0.392)	10.09*** (0.359)	11.94*** (0.389)	10.09*** (0.440)	10.83*** (0.397)
Difference to 2019 wave#[p-value]	0.152	-	**0.001**	0.463	0.371	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**

Notes: Results in the first two columns use the UK Household Longitudinal Study sample weights and those in the third-tenth columns are weighted by our own longitudinal weights. Bootstrapped standard errors for the inequality measures in parenthesis (500 replications).

*** $p < 0.01$ (for the null hypothesis that relative inequality measure is equal to 0).

Test for differences in the inequality measures compared to the corresponding results for the Interim 2019 Wave; bootstrapped p-values using 500 replications. The bold values are statistically significant at $p < 0.05$.

Online Appendix: additional figures and tables

Figure A.1: Total and explained variance of GHQ-12 Likert scores

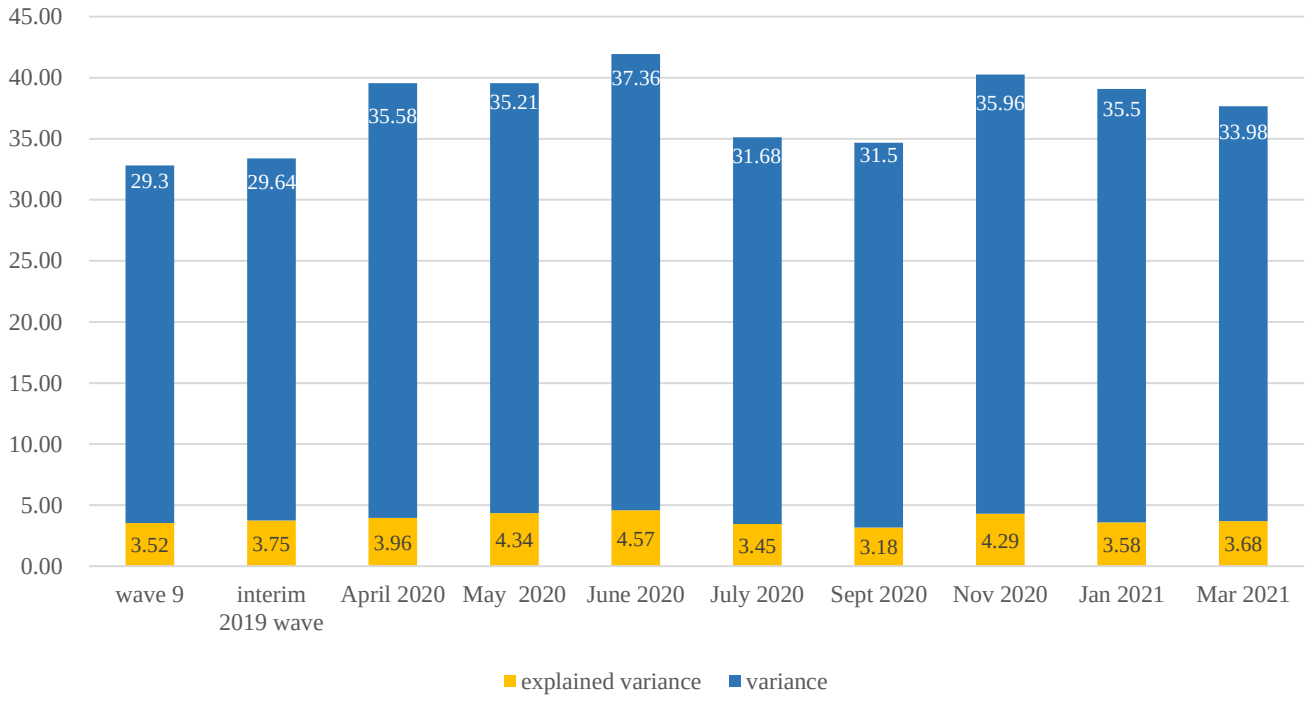

Table A.1: Timeline of events and policies concerning Covid-19 in the UK from January 2020 to March 2021[12]

	Events or social policies in the UK	**date**
First wave	First confirmed UK covid-19 cases	31-Jan-20
	First reported UK covid-19 death	5-Mar-20
	UK government first package financial support (WHO declares Covid-19 as a global pandemic)	11-Mar-20
	First national lockdown ("Spring lockdown" in ONS files)	23-Mar-20
	Five pillar plan for testing	2-Apr-20
	First easing from lockdown ("Spring lockdown" end)	13-May-20
	Second easing from lockdown	1-Jun-20
	Third easing from lockdown	15-Jun-20
	Fourth easing of first lockdown (hospitality reopened)	4-Jul-20
	"The next chapter in our plan to rebuild: The UK Government's COVID-19 recovery strategy" published	17-Jul-20
Second wave	"Rule of six" for partial restriction conducted	14-Sep-20
	Three-tiered system of local alert ("Autumn and Winter restrictions" started in ONS files)	14-Oct-20
	Second lockdown	5-Nov-20
	"Covid-19 winter plan" published	23-Nov-20
	Second lockdown switch to tiered approach	2-Dec-20
	First Covid-19 vaccine clinically approved	2-Dec-20
	First vaccine delivered in the UK	8-Dec-20
	New variant of the virus and tier 4 "stay at home" restrictions	19-Dec-20
	"Autumn and Winter restrictions" over, defined by ONS	4-Jan-21
	Strict national lockdown in the second wave *("Early 2021 lockdown" started, defined by ONS)*	6-Jan-21
	UK COVID-19 vaccine uptake plan published	13-Feb-21
	Roadmap to ease national lockdown published	22-Feb-21
	WHO has issued Emergency Use Listings for the Pfizer/BioNTech, Oxford/AstraZeneca, and Johnson & Johnson COVID-19 vaccines	22-Mar-21
	Schools reopen step-by-step	Mar-21

[12] Reference to Health Foundation public reports: https://www.health.org.uk/adult-social-care-and-covid-19

Table A.2: Summary statistics for circumstance variables

	Wave 9	Interim 2019	April 2020	May 2020	June 2020	July 2020	Sept 2020	Nov 2020	Jan 2021	Mar 2021
Males: age group 20-34 (reference)	0.063	0.063	0.061	0.057	0.053	0.055	0.054	0.052	0.049	0.057
Males: age group 35-49	0.119	0.118	0.118	0.110	0.106	0.105	0.101	0.100	0.097	0.106
Males: age group 50-64	0.151	0.151	0.151	0.150	0.151	0.155	0.155	0.158	0.159	0.155
Males: age group 65+	0.119	0.119	0.120	0.127	0.130	0.131	0.135	0.138	0.138	0.129
Females: age group 20-34	0.092	0.092	0.089	0.087	0.084	0.081	0.078	0.074	0.076	0.082
Females: age group 35-49	0.157	0.157	0.155	0.153	0.151	0.151	0.145	0.145	0.145	0.149
Females: age group 50-64	0.182	0.182	0.186	0.192	0.196	0.194	0.202	0.202	0.202	0.196
Females: age groups 65+	0.118	0.118	0.119	0.125	0.128	0.129	0.129	0.133	0.134	0.125
White (reference)	0.966	0.966	0.969	0.970	0.971	0.972	0.972	0.972	0.973	0.971
Mixed	0.012	0.012	0.010	0.010	0.011	0.010	0.010	0.010	0.009	0.010
Asian	0.017	0.017	0.016	0.015	0.014	0.013	0.013	0.013	0.013	0.014
Black	0.006	0.006	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Degree(reference)	0.379	0.380	0.383	0.386	0.382	0.377	0.378	0.377	0.377	0.381
A-Level/post-secondary	0.330	0.330	0.331	0.328	0.326	0.330	0.332	0.325	0.326	0.332
O-Level/equivalent	0.173	0.173	0.173	0.172	0.173	0.173	0.171	0.180	0.178	0.172
Basic qualification	0.075	0.075	0.073	0.071	0.076	0.076	0.075	0.075	0.075	0.074
No qualification	0.042	0.042	0.041	0.043	0.043	0.043	0.043	0.044	0.044	0.042
Own house outright (reference)	0.385	0.385	0.395	0.407	0.417	0.417	0.426	0.435	0.437	0.426
Mortgage	0.401	0.401	0.401	0.395	0.384	0.379	0.379	0.375	0.368	0.383

Social rent	0.120	0.120	0.114	0.113	0.112	0.117	0.112	0.110	0.110	0.105
Private rent	0.094	0.094	0.090	0.085	0.087	0.087	0.082	0.080	0.085	0.086
Beds to household size ratio	1.369	1.369	1.379	1.392	1.397	1.392	1.409	1.418	1.418	1.399
Number of other rooms	2.032	2.032	2.045	2.053	2.048	2.047	2.048	2.062	2.056	2.063
Single person household	0.151	0.151	0.147	0.152	0.152	0.152	0.154	0.155	0.158	0.150
Lone parent household	0.022	0.022	0.021	0.021	0.020	0.022	0.020	0.020	0.020	0.020
Multi-occupancy household	0.406	0.406	0.403	0.389	0.385	0.388	0.379	0.373	0.374	0.391
Other hh composition (reference)	0.421	0.421	0.429	0.438	0.443	0.438	0.447	0.452	0.449	0.438
Number of children in household	0.282	0.281	0.277	0.265	0.257	0.256	0.245	0.242	0.239	0.256
Self-employed	0.080	0.080	0.080	0.078	0.076	0.075	0.075	0.078	0.074	0.075
Employee (reference)	0.556	0.556	0.557	0.548	0.548	0.544	0.540	0.532	0.535	0.550
Unemployed	0.024	0.024	0.023	0.021	0.021	0.021	0.021	0.021	0.022	0.021
Retired	0.249	0.249	0.252	0.266	0.274	0.276	0.281	0.289	0.288	0.272
Other employment status	0.091	0.091	0.087	0.087	0.082	0.083	0.083	0.080	0.081	0.083
Health and social care sector	0.063	0.062	0.063	0.064	0.064	0.061	0.062	0.063	0.061	0.065
Food industry	0.026	0.026	0.026	0.024	0.023	0.024	0.024	0.023	0.022	0.025
Retail industry	0.054	0.054	0.054	0.052	0.052	0.055	0.052	0.051	0.051	0.052
Transportation industry	0.024	0.024	0.024	0.025	0.026	0.024	0.023	0.024	0.023	0.025
Education and sports industry	0.105	0.106	0.106	0.106	0.104	0.105	0.102	0.102	0.103	0.100
Household income (waves1-8)	2006.68	2006.83	2026.42	2021.78	2019.87	1999.88	2021.45	2026.35	2022.53	2020.95
Neighbourhood: poor/ fair medical facilities	0.250	0.250	0.246	0.244	0.247	0.251	0.247	0.250	0.253	0.249
Neighbourhood: poor/fair leisure	0.500	0.500	0.502	0.504	0.506	0.506	0.506	0.506	0.505	0.508

facilities										
Father: Skill level 4 (reference)	0.183	0.183	0.187	0.187	0.186	0.184	0.187	0.185	0.187	0.188
Father: Skill level 3	0.363	0.363	0.362	0.364	0.367	0.365	0.365	0.370	0.370	0.366
Father: Skill level 2	0.212	0.212	0.214	0.213	0.211	0.214	0.213	0.213	0.213	0.212
Father: Skill level 1	0.070	0.070	0.069	0.072	0.073	0.073	0.072	0.072	0.072	0.071
Father unemployed	0.039	0.039	0.039	0.038	0.039	0.038	0.035	0.036	0.037	0.039
Missing data	0.133	0.133	0.129	0.126	0.125	0.128	0.128	0.124	0.121	0.124
Mother: Skill level 4 (reference)	0.110	0.110	0.109	0.112	0.109	0.108	0.110	0.106	0.109	0.108
Mother: Skill level 3	0.076	0.076	0.074	0.073	0.072	0.073	0.075	0.073	0.075	0.074
Mother: Skill level 2	0.274	0.273	0.275	0.277	0.279	0.276	0.275	0.273	0.272	0.274
Mother: Skill level 1	0.126	0.126	0.127	0.128	0.128	0.132	0.128	0.129	0.129	0.129
Mother unemployed	0.332	0.333	0.335	0.337	0.340	0.338	0.339	0.346	0.343	0.341
Missing data	0.082	0.082	0.080	0.073	0.072	0.073	0.074	0.074	0.071	0.074
Respiratory conditions	0.148	0.148	0.144	0.147	0.144	0.146	0.144	0.141	0.145	0.146
Cardiovascular conditions	0.214	0.214	0.215	0.222	0.225	0.225	0.230	0.233	0.233	0.222
Endocrine diseases	0.135	0.135	0.134	0.139	0.139	0.142	0.144	0.146	0.144	0.137
Arthritis	0.126	0.126	0.126	0.132	0.136	0.136	0.139	0.139	0.138	0.136
Other conditions	0.203	0.203	0.202	0.205	0.206	0.209	0.209	0.205	0.211	0.205
Notes: Summary statistics are weighted using UKHLS sample weights (Wave 9 columns) and our longitudinal sample weights (COVID-19 waves). The division and sample size at each wave are the same as in Table 1.										

Table A.3: Mean values for the GHQ outcomes

	Wave 9	Interim 2019	April 2020	May 2020	June 2020	July 2020	Sept 2020	Nov 2020	Jan 2021	Mar 2021
GHQ-12 elements[a]										
Concentration	0.154	0.162	0.275***	0.247***	0.239***	0.177**	0.179**	0.222***	0.241***	0.200***
Sleep	0.143	0.148	0.236***	0.198***	0.202***	0.157	0.174***	0.208***	0.205***	0.182***
Role	0.126	0.129	0.272***	0.236***	0.210***	0.161***	0.168***	0.186***	0.209***	0.174***
Decisions	0.086	0.091	0.131***	0.127***	0.139***	0.108***	0.170***	0.135***	0.135***	0.127***
Strain	0.220	0.220	0.283***	0.260***	0.261***	0.211	0.236**	0.268***	0.259***	0.244***
Overcoming Difficulty	0.124	0.130	0.140	0.142	0.156***	0.127	0.136	0.159***	0.146**	0.143
Enjoy activities	0.160	0.168	0.462***	0.417***	0.372***	0.278***	0.256***	0.383***	0.411***	0.327***
Face up problems	0.094	0.098	0.124***	0.120***	0.131***	0.106	0.115***	0.131***	0.129***	0.121***
Depressed	0.184	0.196	0.270***	0.255***	0.236***	0.201	0.214**	0.267***	0.283***	0.234***
Confidence	0.148	0.157	0.158	0.175***	0.174***	0.154	0.151	0.175***	0.175**	0.171**
Worthlessness	0.078	0.082	0.090	0.096***	0.101***	0.085	0.085	0.104***	0.097***	0.094**
Happiness	0.142	0.148	0.231***	0.206***	0.200***	0.171***	0.181***	0.225***	0.255***	0.204***
GHQ-12 Likert[b]	11.08**	11.23	12.30***	12.26***	12.36***	11.66***	11.78***	12.69***	12.74***	12.22***
Caseness ≥4[c]	0.172**	0.186	0.278***	0.257***	0.245***	0.201**	0.207***	0.257***	0.270***	0.228***
Sample size	**8317**	**8278**	**7515**	**7028**	**6790**	**6643**	**6299**	**5988**	**5931**	**6226**

Notes: Results in the first two columns use the UK Household Longitudinal Study sample weights and those in the third-tenth columns are weighted by our own longitudinal weights. Bootstrapped standard errors (500 replications) are used for inference. a: Binary variable for each of the GHQ dimensions: better mental health is coded as 0. b: Continuous overall GHQ-12 Likert scoring (ranging between 0 and 36). c: Dichotomous variable scored 1 if the overall GHQ-12 Caseness score ≥4 and 0 otherwise. *** Differences in the mean values (or variance) compared to the corresponding results at the Interim 2019 Wave are statistically significant at 1% level; ** Differences are statistically significant at 5% level.

Table A.4: Measures of socioeconomic inequality of the GHQ-12 elements

	Wave 9	Interim 2019	April 2020	May 2020	June 2020	July 2020	Sept 2020	Nov 2020	Jan 2021	Mar 2021
Concentration θ_I	0.245*** (0.009)	0.242*** (0.010)	0.218*** (0.011)	0.211*** (0.011)	0.216*** (0.012)	0.242*** (0.010)	0.241*** (0.012)	0.207*** (0.013)	0.207*** (0.014)	0.224*** (0.011)
Difference p-value#	0.764	-	0.132	**0.038**	0.090	0.938	0.969	**0.029**	**0.033**	0.308
Sleep θ_I	0.241*** (0.009)	0.226*** (0.009)	0.219*** (0.011)	0.216*** (0.010)	0.204*** (0.011)	0.233*** (0.010)	0.215*** (0.011)	0.202*** (0.012)	0.201*** (0.012)	0.232*** (0.012)
Difference p-value#	0.339	-	0.669	0.550	0.167	0.644	0.527	0.139	0.126	0.710
Role θ_I	0.268*** (0.009)	0.267*** (0.009)	0.174*** (0.010)	0.204*** (0.012)	0.221*** (0.011)	0.220*** (0.011)	0.236*** (0.011)	0.223*** (0.013)	0.191*** (0.011)	0.220*** (0.010)
Difference p-value#	0.956	-	**0.000**	**0.000**	**0.006**	**0.011**	0.063	**0.009**	**0.000**	**0.009**
Decisions θ_I	0.290*** (0.008)	0.286*** (0.008)	0.246*** (0.009)	0.273*** (0.011)	0.265*** (0.011)	0.265*** (0.009)	0.263*** (0.010)	0.230*** (0.011)	0.242*** (0.012)	0.236*** (0.010)
Difference p-value#	0.869	-	**0.045**	0.505	0.309	0.298	0.268	**0.009**	**0.042**	**0.007**
Strain θ_I	0.232*** (0.010)	0.228*** (0.011)	0.218*** (0.011)	0.217*** (0.012)	0.223*** (0.012)	0.225*** (0.011)	0.210*** (0.011)	0.200*** (0.014)	0.224*** (0.014)	0.204*** (0.013)
Difference p-value#	0.739	-	0.399	0.410	0.685	0.852	0.155	**0.036**	0.777	0.063
Overcoming difficulties θ_I	0.307*** (0.010)	0.294*** (0.010)	0.252*** (0.010)	0.278*** (0.012)	0.266*** (0.011)	0.276*** (0.011)	0.269*** (0.011)	0.263*** (0.014)	0.253*** (0.012)	0.269*** (0.011)
Difference p-value #	0.422	-	**0.024**	0.419	0.118	0.340	0.164	0.084	**0.026**	0.184
Enjoy activities θ_I	0.235*** (0.009)	0.238*** (0.009)	0.086*** (0.011)	0.089*** (0.011)	0.117*** (0.011)	0.154*** (0.012)	0.156*** (0.011)	0.103*** (0.012)	0.101*** (0.013)	0.129*** (0.012)
Difference p-value#	0.912	-	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**

Table A.4: Measures of socioeconomic inequality of the GHQ-12 elements (extended)

	Wave 9	**Interim 2019**	**April 2020**	**May 2020**	**June 2020**	**July 2020**	**Sept 2020**	**Nov 2020**	**Jan 2021**	**Mar 2021**
Face up problems θ_I	0.298*** (0.008)	0.297*** (0.008)	0.270*** (0.009)	0.277*** (0.010)	0.287*** (0.012)	0.277*** (0.010)	0.281*** (0.011)	0.259*** (0.013)	0.228*** (0.011)	0.277*** (0.010)
Difference p-value#	0.960	-	0.156	0.307	0.590	0.334	0.424	0.078	**0.001**	0.324
Depressed θ_I	0.223*** (0.010)	0.206*** (0.010)	0.177*** (0.011)	0.195*** (0.012)	0.207*** (0.012)	0.211*** (0.011)	0.215*** (0.012)	0.174*** (0.013)	0.170*** (0.014)	0.179*** (0.011)
Difference p-value#	0.215	-	**0.026**	0.395	0.897	0.713	0.504	**0.018**	**0.007**	0.060
Confidence θ_I	0.270*** (0.009)	0.255*** (0.010)	0.275*** (0.009)	0.259*** (0.011)	0.256*** (0.011)	0.255*** (0.012)	0.270*** (0.012)	0.257*** (0.013)	0.238*** (0.012)	0.265*** (0.012)
Difference p-value#	0.335	-	0.213	0.818	0.938	0.988	0.373	0.891	0.270	0.522
Worthlessness θ_I	0.347*** (0.008)	0.363*** (0.009)	0.309*** (0.009)	0.339*** (0.010)	0.305*** (0.010)	0.312*** (0.010)	0.368*** (0.012)	0.331*** (0.012)	0.293*** (0.012)	0.329*** (0.010)
Difference p-value#	0.404	-	**0.016**	0.237	**0.007**	**0.029**	0.888	0.141	**0.003**	0.123
Happiness θ_I	0.255*** (0.009)	0.245*** (0.009)	0.165*** (0.011)	0.197*** (0.011)	0.229*** (0.011)	0.232*** (0.011)	0.226*** (0.012)	0.168*** (0.013)	0.154*** (0.012)	0.202*** (0.011)
Difference p-value#	0.508	-	**0.000**	**0.004**	0.280	0.429	0.203	**0.000**	**0.000**	**0.005**

Notes: Results in the first two columns use the UK Household Longitudinal Study sample weights and those in the third-tenth columns are weighted by our own longitudinal weights. Bootstrapped standard errors for the inequality measures in parenthesis (500 replications).

*** $p < 0.01$ (for the Ho hypothesis that the dissimilarity index is equal to 0).

#Test for differences in the inequality measures compared to the corresponding results for the Interim 2019 Wave; bootstrapped p-values using 500 replications. The bold values are statistically significant at $p < 0.05$.

Table A.5: Decomposition analysis of socioeconomic inequality of GHQ-12 Likert scores (percentage contributions)

	Wave 9	Interim 2019	April, 2020	May, 2020	June, 2020	July, 2020	Sept, 2020	Nov, 2020	Jan, 2021	Mar, 2021
Males 35-49	0.24	0.31	1.4	0.41	0.42	0.44	0.37	0.4	1	0.4
Males 50-64	1.16	1.91	5.74	3.46	3.03	3.2	1.8	3.91	3.81	2.07
Males 65+	7.19	6.13	10.1	8.86	7.99	9.78	9.91	10.07	10.27	8.97
Females 20-34	2.3	1.77	9.57	4.73	2.55	1.54	2.68	5.52	6.49	2.28
Females 35-49	1.88	2.54	4.39	3.05	3.36	3.73	3.35	5.36	4.79	7.19
Females 50-64	0.78	0.66	1.14	0.78	0.64	0.77	1.25	0.71	0.79	0.72
Females 65+	2.02	1.79	1.14	0.98	0.92	1.01	0.78	1.22	1.15	1.12
Age and gender total	15.57	15.11	33.48	22.27	18.91	20.47	20.14	27.19	28.3	22.75
Chronic conditions	32.9	32.88	20.71	21.42	33.23	26.94	29.94	21.52	24.88	26.81
Housing conditions	18.44	20.13	14.35	21.39	16.51	16.62	16	20.61	18.44	14.57
Employment status	15.56	15.39	11.42	11.96	10.44	10.59	10.36	9.22	9.4	9.99
Household composition	5.53	5.01	6.41	7.46	6.6	3.62	5.96	5.96	4.44	5.69
Covid19-related industry	4.47	4.37	4.83	6.71	5.28	10.15	4.98	3.81	6.02	7.71
Parental occupation	1.16	1.23	2.76	1.31	1.48	2.45	4.02	3.36	4.23	5.8
Neighborhood	0.85	1.09	2.72	2.01	1.8	3.42	2.9	3.45	1.38	2.41
Ethnicity	0.83	0.36	1.4	0.98	1.44	1.92	0.35	0.85	0.41	1.42
Income	4.05	3.82	1.17	2.66	2.99	2.13	4.2	2.15	1.45	1.46
Education	0.65	0.61	0.76	1.82	1.31	1.7	1.16	1.87	1.04	1.3

Table A.6: Decomposition analysis of socioeconomic inequality of GHQ dichotomous caseness ≥4 (percentage contributions)

	Wave 9	Interim 2019	April, 2020	May, 2020	June, 2020	July, 2020	Sept, 2020	Nov, 2020	Jan, 2021	Mar, 2021
Age and gender	19.66	15.07	33.47	24.14	20.67	15.91	17.72	20.96	23.89	21.84
Chronic conditions	23.56	26.57	14.64	14.95	24.01	26.33	24.48	16.42	20.32	25.04
Housing conditions	16.24	19.01	13.33	16.2	12.88	13.1	13.25	15.65	13.88	13.18
Employment status	14.01	13.43	11.44	10.67	10.73	8.4	7.08	7.13	7.35	8.85
Neighborhood	1.31	2.56	6.54	2.67	2.58	3.84	4.97	6.34	3.21	2.87
Parental occupation	3.25	2.61	5.04	4.58	4.08	4.13	7.64	5.38	5.41	8.68
Household composition	7.83	8.04	5.91	9.78	9.95	7.19	7.02	10.17	8.44	7.25
Education	1.47	1.28	4.28	7.03	5.22	4.66	5.97	5.31	7.98	4.45
Covid19-related industry	5.72	5.76	3.81	6.66	7.16	12.64	6.15	6.52	6.94	5.96
Ethnicity	1.6	0.73	1.01	0.61	0.53	1.07	0.9	1.27	0.73	0.34
Income	5.34	4.94	0.53	2.72	2.2	2.73	4.81	4.86	1.85	1.53
Note: Factor contributions are ordered according to their contributions at the April 2020 Covid Wave.										