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# Covid-19 and Mental Health of Individuals with Different Personalities

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1 **Several studies have been devoted to establishing the effects of the**  
2 **Covid-19 pandemic on mental health across gender, age and ethnici-**  
3 **ty. However, much less attention has been paid to the differential**  
4 **effect of lockdown according to different personalities. We do this**  
5 **using the UK Household Longitudinal Study (UKHLS), a large-scale**  
6 **panel survey representative of the UK population. The UKHLS al-**  
7 **lows us to assess the mental health of the same respondent before**  
8 **and during the Covid-19 period based on their “Big Five” personality**  
9 **traits and cognitive skills. We find that during the Covid-19 period**  
10 **individuals who have more Extrovert and Open personality report**  
11 **a higher mental health deterioration, while those scoring higher in**  
12 **Agreeableness are less affected. The effect of Openness is particu-**  
13 **larly strong: one more standard deviation predicts up to 0.23 more**  
14 **symptoms of mental health deterioration in the GHQ-12 test, during**  
15 **the Covid-19 period. In particular for females, Cognitive Skills and**  
16 **Openness are strong predictors of mental health deterioration, while**  
17 **for non-British-white respondents, these predictors are Extraversion**  
18 **and Openness. Neuroticism strongly predict worse mental health**  
19 **cross-sectionally, but it does not lead to significantly stronger de-**  
20 **terioration during the pandemic. The study’s results are robust to**  
21 **the inclusion of potential confounding variables such as changes in:**  
22 **physical health, household income and job status (like unemployed**  
23 **or furloughed).**

Covid-19 | Mental Health | Big 5 | Cognitive Skills

1 **T**he question of whether Covid-19 affects the mental health  
2 of different individuals in differently ways is very open and  
3 compelling. Several studies have been devoted to establishing  
4 the effects on different age, gender and ethnicity (e.g. 1–6).  
5 However, little attention has been paid to the differential effect  
6 of Covid-19 according to the differences in individual personalities  
7 (exceptions include (7–10), which we will discuss in detail later  
8 in the text).

9 Analyzing the differential effect of the pandemic according  
10 to personality is important at least for three reasons. First,  
11 it can lead to identification of at-risk groups as well as more  
12 personalized psychological or psychiatric treatments, even for  
13 the post-Covid period. Second, understanding how individuals  
14 with different personality react to an extreme condition like a  
15 lockdown can shed more light on the link between personality  
16 and mental health. Third, it can make clearer unintended con-  
17 sequences of Covid-19 restrictions and inform policy-making.

18 The Covid-19 period can be thought as a natural experiment  
19 where a sort of stress test is naturally induced. The UK  
20 Household Longitudinal Study (UKHLS) provides longitudinal  
21 data for the same sample of individuals representative of UK  
22 population, where mental health is monitored before and  
23 during the Covid-19 period. Furthermore, the UKHLS dataset  
24 provides necessary information about personality traits and  
25 cognitive skills that are the main explanatory variables in the

current study. Hence the UKHLS is an ideal tool to analyze  
the effects of this pandemic on mental health deterioration  
among individuals with different personalities.

Some confounding factors are potentially relevant in our  
study. We show that our results are robust to the inclusion  
of controls such as changes in: physical health, household  
income, job status (like unemployed or furloughed), marital  
status, household size and geographic location, during the  
Covid-19 period.

There is a widespread consensus on the personality classi-  
fication based on the OCEAN five-factor model, or Big Five  
(11–14). And, following this classification, there is a large  
literature analyzing the link between personality and mental  
health (e.g. 15–17).<sup>\*</sup> Further, there are several contributions  
studying how personality affects self-reported subjective well-  
being (e.g. 20–23). We show that the data used in the current  
study produce results that are consistent with these contribu-  
tions. Building on this literature, to the best of our knowledge,  
we are the first to show using longitudinal data representative  
of a country large population how an external shock interacts  
with personality to affect mental health. The panel struc-  
ture of the UKHLS dataset (i.e. same individuals observed  
in different periods) allows us to analyze the deterioration of  
mental health with respect to a pre-Covid-19 baseline period

<sup>\*</sup>A comprehensive review of this large literature is beyond the scope of this paper. We refer the reader to (18) for exhaustive meta-analysis and review of this literature, and to (19) for an illustration of the models linking personality to depression.

## Significance Statement

Analyzing how personality affects the mental health deterioration during the pandemic is important because it can lead to more personalized psychological or psychiatric treatments. Drawing on a longitudinal dataset representative of the UK population before and during the pandemic, we document that personality can be an important factor. In particular, Agreeableness is a negative predictor; while Openness and, to a lower extent, Extraversion are positive predictors; The effect of Neuroticism is surprisingly weak. In female respondents, Cognitive Skills and Openness, and in non-British-white respondents, Extraversion and Openness, are particularly strong predictors of mental health deterioration. The fact that Neuroticism has an effect that is weaker than expected represents an interesting puzzle.

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Both Authors have no competing interests.

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and, therefore, to estimate the effect of the different traits excluding the confounding effects due to any time-invariant factor.

Some recent contributions (7–10) have emphasized how personality traits can affect individual mental health during the pandemic period. While they are generally consistent with our results, these studies are based on non-probability sampling methods, smaller samples than the one used in this study, and do not use a clear pre-Covid-19 baseline of data to precisely identify the deterioration of mental health. In the discussion section we will describe these contributions in more details.

We find that during the Covid-19 period individuals who have more Extrovert and Open personality report a higher mental health deterioration, while the ones scoring high in Agreeableness are less affected. The effect of Openness is particularly strong and seems increasing in magnitude thorough the entire period.

Neuroticism seems to predict more mental health deterioration, but this effect is not significant in the main specifications of the estimated model. This last result, unveils an important puzzle since Neuroticism is considered an index of sensibility to threats hence, highly Neurotic individuals should be particularly affected in an environment like the Covid-19 pandemic. We further discuss this issue—together with the other main results—in detail in the last section.

## Materials and Methods

**Data.** Our main data source is the Covid-19 Survey from the UK Household Longitudinal Study (UKHLS), or Understanding Society. We combine seven waves of the Covid-19 Survey (April, May, June, July, September, November 2020, and January 2021), with Wave 9 main survey (2017-2019), which serves as the baseline for the pre-Covid-19 period (24, 25). This leads to seven panels, each with a during- and pre-Covid-19 period. Each panel is balanced (i.e. contain two observations per respondent) with 11166 data points each.

We apply the longitudinal sampling weights provided in the UKHLS to make inference on the UK population. A key feature of the Covid-19 Survey is that it is longitudinal, enabling individuals to be tracked over the course of the pandemic. In this balanced panel, there are 8772 individuals with basic demographic information on gender, age and ethnicity (see SI Appendix, Table S1). We further merge this data with Wave 9 main survey to construct the pre-Covid baseline data, and Wave 3 main survey to include information on personality traits and cognitive skills. At the end of this process we have a total of 5583 individuals and an attrition of about 36%, of which about 21% (i.e. determined by the difference between 8772 and 6928) is due to exogenous survey sampling factors related to the difference in the respondents present the different waves, while the other 16% (i.e. determined by the difference between 6928 and 5583) is due to missing data.

While this attrition rate can be considered substantial, it positively compares with previous research using the same data (3, 6). This attrition does not significantly bias the panel in terms of personality, traits, gender and education, as we note from column 5 of Table S1 in the SI Appendix. Our main concern with attrition, is that respondents with certain personality traits systematically drop out of the sample, thus causing a sampling bias in terms of personality traits. Comparisons in columns 5 and 6 show that this is not the case, lending support to our research design. The final sample is, however, 3.7 years older than the initial one. A main reason is that since Wave 3 main survey, younger individuals have been added to and older individuals have dropped out from the Covid-19 Survey. In the final panel the age range is 24–93, while in the initial balanced Covid-19 Study panel, this is 16–96, hence to

the extent that we consider this sample as representative of the UK population within the age range of 24–93, the exogenous attrition should not represent a threat to representativeness of our sample.

With this in mind, we note from column 6 (measuring the effect of the attrition due to missing data) that there is no significant difference in the mental health indicators (GHQ-12) and in almost all the socioeconomic factors. The age difference is significantly reduced to less than 1 year and, accordingly, the only significant difference at 5% level is now in the share of retired (about 0.02 smaller). All that provides support that sample selection bias plays little or no role on our analysis and little or no threat to the representativeness of the sample (to the extent that we consider the sample as representative of adults aged between 24–93). All variables included in the regressions and with their statistical descriptions are listed in the SI Appendix, Table S2.

**Mental Health** The index of mental health we use is the 12-item General Health Questionnaire, GHQ-12 (26). The GHQ-12 is a well-known self-report instrument for evaluating minor psychiatric disorders, which may signal the beginning of serious disorders, where the respondent must report the extent to which 12 symptoms of mental health deterioration are present in the past few weeks on a Likert scale, we consider the “caseness” formulation ranging from 0 to 12, which represents the number of symptoms felt “more than usual” or “much more than usual” (we present the questionnaire in SI Appendix, Section 1). We prefer this to the “score” formulation—which is the sum of each single answer from 1 to 4—because the latter is a cumulative measure of the symptoms’ intensity, which is arguably less objective hence less comparable across individuals. We will see below that the results are qualitatively similar—stronger if anything—when we use the score formulation.

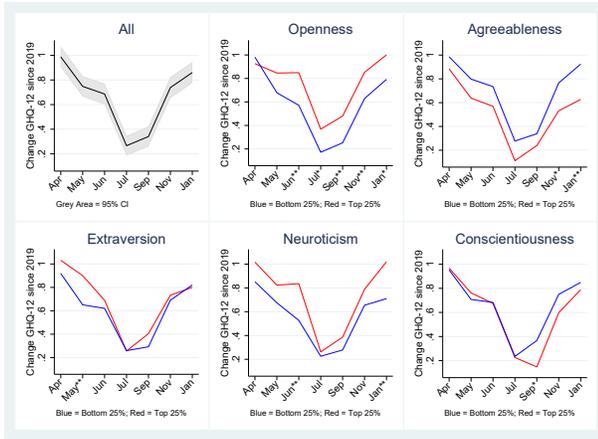
**Big Five Personality Traits** We use the Personality classification based on the big 5 Five-Factor Model, which is the most common classification (11–13). These “Big Five” are: Neuroticism (or Emotional Stability), Extraversion, Conscientiousness, Agreeableness, and Openness, usually measured through self-report based on the NEO Five-Factor Inventory (see e.g. 14), with 60 items (12 items per domain). However, scale-development studies have indicated that the Big Five traits can be reliably assessed with a smaller number of items (e.g. 27, 28) that can be used in large-scale surveys. The current data are measured with a short 15-item questionnaire (3 per each of the Big-5 traits). A detailed description of the questions are available in SI Appendix, Section 1. This information is measured in Wave 3 of UKHLS main survey (in 2011–13). (29) argue that personality traits vary little for individuals aged between 18 and 65. Given that traits and cognitive skills have been measured in 2011–13, we will check whether excluding over 60 and under 27s from the analysis substantially changes our results.† In SI Appendix, Table S3, we present the correlation matrix between personality traits, cognitive skills, and gender. As it is normally observed, Neuroticism is negatively correlated with all other traits that are otherwise positively correlated with each other. As it is normally the case, the correlation between Openness and Cognitive skills is positive and rather substantial (see the discussion section for more details on this).

**Control Variables** We use a measure of cognitive skills as a control variable. They have also been measured in Wave 3 main survey of the UKHLS (in 2011–13). We use the 1<sup>st</sup> principal component of all measures provided in the main UKHLS dataset, apart from the self-rated memory (the questions are presented in SI Appendix, Section 1 (see 31, for details).

Moreover, we introduce as covariates: job status, household income (in logarithm), missing income (dummy), any long term health condition, month of the interview (dummies), age, region, marital status, household size, and presence of children in the household. Summary statistics for all variables are listed in SI Appendix, Table S2.

**Econometric Models.** We have a series of balanced panels with two periods each, so every respondent is recorded twice: once in the pre-Covid-19 wave (i.e. Wave 9 main survey, related to period 2017–19) and once in each of the wave within the Covid-19 period (April, May, June, July, September, November 2020, January 2021). Using

† Furthermore, (30) show that they change very little even after very serious shocks like bereavement or unemployment.



**Fig. 1. Mental health deterioration in the Covid-19 period, in total and among individuals with different personality traits**  
 The changes in GHQ-12 represent mental health deterioration between the pre-Covid wave and each wave during the Covid-19 period. The black line in the top left panel represents the overall average, while the other panels report the averages among subjects with the top (red lines) and bottom (blue lines) 25% score in each personality trait. GHQ-12 index is the number of symptoms—up to 12—indicating some form of mental disorders. \*\* and \* next to the months denote statistical significance of the difference between the two lines at 0.05, and 0.1 levels respectively.

The top left panel of Fig. 1 presents the evolution of average mental health deterioration, as measured by the increase in GHQ-12 caseness (or symptoms) between each wave during Covid-19 and the baseline (2017–19), for all selected respondents from April 2020 to January 2021.

We note a timeline of significant Covid-19 restriction policies adopted by the UK government as below. On March 23<sup>rd</sup> 2020, the Prime Minister announces UK wide lockdown; on May 10<sup>th</sup>, ‘Stay at home’ becomes ‘stay alert’ and the Prime Minister (PM) sets out lockdown lifting plan; on July 4<sup>th</sup>, most restrictions are lifted in England. On October 31<sup>st</sup>, PM announces that England is placed under another national lockdown. On December 2<sup>nd</sup>, England’s national lockdown comes to an end and is replaced by a strengthened three-tier system. On January 4<sup>th</sup> 2021, PM announces a third national lockdown for England.

In Fig. 1, we observe a V-shaped path of mental health deterioration from April 2020 to January 2021. Figure 1 shows a dramatic rise in GHQ-12 in April of about one unit (i.e. one more symptom per individual) then a decline during late spring and early summer and an increase again in autumn 2020 and January 2021. This path roughly mirrors the evolution of the infections and restrictions. The average mental health deterioration (i.e. average GHQ-12 changes) over the entire period from April 2020 to January 2021 is around 0.66 symptoms (i.e. two out of three respondents experienced one more symptom on average).

The other five panels of Figure 1 present the GHQ-12 evolution for individuals scoring high and low in each personality trait (more precisely, belonging to top and bottom 25% of each personality score). A visual inspections of the five panels reveals clear differences in mental health deterioration for respondents at the top and bottom ends of all five traits. In particular, individuals high in Openness and low in Agreeableness seem to have experienced stronger mental health deterioration than their counterparts to the other extremes. Neuroticism seems to affect individuals in the natural direction, i.e. respondents scoring high in Neuroticism experienced worse mental health deterioration than those scoring low. Extraversion seems to have more heavily affected respondents at the beginning of the period, while Conscientiousness in the second half.

The evidence presented in Fig. 1 provides a first indication of a differential impact of the Covid-19 period on mental health. There are, however, some potential confounding factors in the relationship between personality and mental health deterioration during the period of analysis. For example, personality can affect the probability of becoming unemployed or lead a lower wage during the Covid-19 period (e.g. 23, 29) and, in turn, both these factors that can affect the mental health. Therefore, as previously argued in Section 1, we move on to estimate model 1 which controls for such confounding factors, to assess the relationships suggested in Fig. 1.

Estimation results of model 1 are presented in Fig. 2 and SI Appendix, Table S9. Fig. 2 plots the main coefficients of interest, to visualize the differential effects of Covid-19 on mental health across different personality traits, for each month during the pandemic (April, May, June, July, September, November 2020, and January 2021), compared against the pre-Covid-19 baseline period (i.e. Wave 9 main survey, 2017–19). For comparison, results for a specification excluding control

187 this dataset, we estimate the following model for each two-period  
 188 panel:

$$189 \quad GHQ_{i,t} = t\theta_i\Gamma + y_{i,t}\Delta + r_i + \epsilon_{i,t}; \quad [1]$$

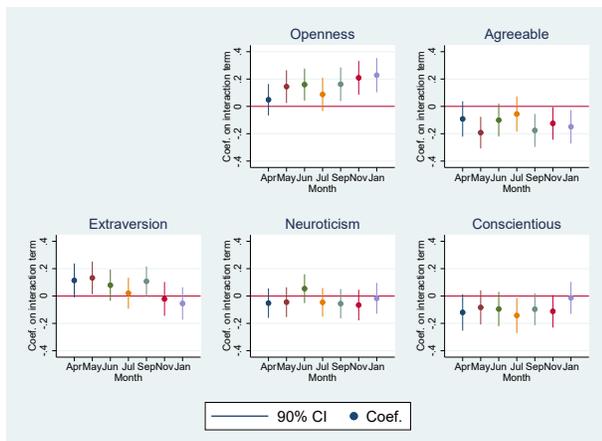
where  $i$  represents the individual,  $t = 0$  indicates the period of Wave 9 main survey, and  $t = 1$  denotes each period of the seven waves during the Covid-19 pandemic.  $GHQ_{i,t}$  is the mental health indicator,  $\theta_i$  is the vector of the time-invariant individual characteristics, including personality traits—our variable of interest, cognitive skills and gender,  $y_{i,t}$  are the time-variant control variables for each respondent (e.g. income), and  $r_i$  are the individual-specific fixed effects. The vector of time-invariant characteristics is:

$$\theta_i = (N_i, E_i, C_i, A_i, O_i, CS_i, Sex_i, 1);$$

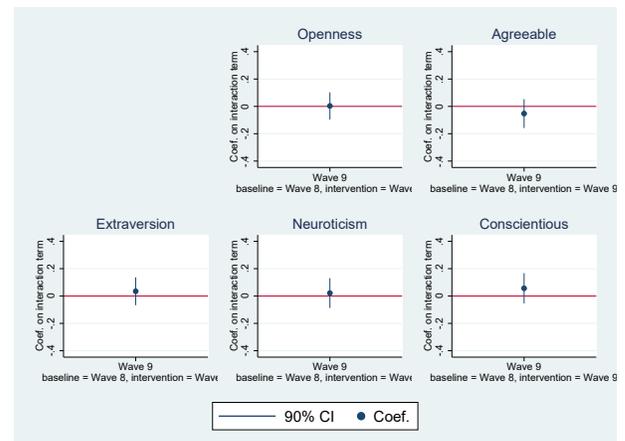
190 where  $N$  = Neuroticism,  $E$  = Extraversion,  $C$  = Conscientiousness,  
 191  $A$  = Agreeableness,  $O$  = Openness,  $CS$  = Cognitive Skills,  $Sex$  =  
 192 Female, and 1 is the constant term. The term  $t\theta_i\Gamma$  represents the  
 193 interaction of a personality trait and other time-invariant individual  
 194 characteristics with  $t$ , which is equal to 1 for the Covid-19 period  
 195 and 0 otherwise. Therefore, some components of vector  $\Gamma$  repre-  
 196 sent our main coefficients of interest.  $\epsilon_{i,t}$  is an idiosyncratic error  
 197 assumed, as usual, to be uncorrelated with the regressors. In the  
 198 regression estimating Equation 1, we cluster the standard errors  
 199 at the individual levels (i.e. we make the standard assumption,  
 200 given the above specification of the model with individual fixed ef-  
 201 fects, that errors are uncorrelated across individuals, but correlated  
 202 within).

## 203 Results

204 In SI Appendix Section 2, we report a sanity check of our data.  
 205 We show that the results (see SI Appendix, Tables S4–S7) are  
 206 to a large extent consistent with the findings in the literature  
 207 analyzing how personality affects mental health (e.g. 18, 19),  
 208 and also in line with the literature on subjective wellbeing (e.g.  
 209 20–23), with a strong negative effect of Neuroticism, and  
 210 positive effects of Conscientiousness and Extraversion that are  
 211 smaller in magnitude.



**Fig. 2. Coefficient plots of the effects of Covid-19 on mental health, overall and by personality traits** This figure plots the main coefficients of interest, estimated using model 1 for each pair of a period during Covid-19 and the pre-Covid-19 baseline period. The dependent variable is GHQ-12. Each dot represents the coefficient of an interaction term between a specific trait and the Covid-19 period, for each Covid-19 wave. The spike plots refer to the 90% confidence intervals.



**Fig. 3. Coefficient plots for the effects of a placebo intervention on mental health, overall and by personality traits** This figure plots the main coefficients of interest, estimated using model 1 for each pair of a period during a placebo intervention period (Wave 9 main survey) and the baseline (Wave 8 main survey). The dependent variable is GHQ-12. Each dot represents a coefficient, and the spike plots the 90% confidence interval. Each plot represents the coefficient and confidence interval for the interaction term between "During intervention period" and a personality trait.

273 variables are presented in the SI Appendix, Table S8 and  
274 Figure S1.

275 We note that some personality traits significantly predict  
276 more mental health deterioration, with a non-negligible magni-  
277 tude. To have an idea, a coefficient of about 0.15 implies that  
278 one standard deviation in personality increases leads to 0.15  
279 symptoms on the GHQ-12 measure, i.e. one out of seven re-  
280 spondents reporting one more symptom in the Covid-19 period;  
281 and we recall that the average mental health deterioration in  
282 the Covid-19 period is about 0.66 more symptoms.

283 In particular, personalities with low score in Agreeableness  
284 and high score in Openness predict more mental health dete-  
285 rioration during the Covid-19 period. The effect of Openness  
286 seems to be increasing throughout the period and it is remark-  
287 ably high in January 2021, where a one standard deviation  
288 increase in Openness predicts an increase of 0.23 symptoms on  
289 average. The interaction with Extraversion is weakly signifi-  
290 cant in the second period, but if we consider the GHQ-12 scale  
291 (range 0–36) instead (SI Appendix, Table S10) this becomes  
292 strongly significant at 5% level for the second period and  
293 marginally significant at 10% for the first and third periods.  
294 The interaction with Conscientiousness is weakly significant in  
295 the 4<sup>th</sup> wave. Neuroticism is surprisingly insignificant in this  
296 specification.<sup>‡</sup> We also test whether Neuroticism significantly  
297 interacts with other personality traits in predicting mental  
298 health deterioration, but we find no evidence supporting this  
299 (SI Appendix, Table S12).

300 To make sure we are not picking up diverging trends or  
301 time effects due to different personality traits, we further  
302 run a placebo test, with Wave 9 in the main survey as the  
303 intervention period and Wave 8 as the baseline period. The  
304 coefficients of interest are plotted in Fig. 3. In this test, we  
305 are not able to detect any significant differential effects due to  
306 personality traits across these two waves, lending support to

<sup>‡</sup> To understand better this apparent discrepancy with Figure 1, where there seem to be a significant difference between top and bottom 25% Neuroticism scorers, in SI Appendix Table S11, we show that this difference vanishes once a general dummy variable indicating the Covid-19 period is introduced, suggesting that this effect is rather weak.

307 the notion that the diverging trends in mental health across  
308 different levels of personality traits are specific to the Covid-  
309 19 period. Further details of this test are provided in SI  
310 Appendix, Table S13. We also check for robustness to other  
311 psychological factors that might be correlated with personality  
312 traits, including optimism, risk attitude, and locus of control  
313 (see Appendix SI, Table S14). The results are also very similar  
314 if we omit sampling weights (SI Appendix, Table S15) or  
315 apply inverse probability weighting to address attrition issue  
316 (SI Appendix, Table S16 and Figure S2), exclude those over 60s  
317 and under 27s (SI Appendix, Table S17), or consider different  
318 specifications of model 1 (SI Appendix, Tables S18 and S19).

319 We further explore heterogeneity across demographic di-  
320 mensions. In Table 1, we report the results of the estimation  
321 of model 1 for males and females separately.<sup>§</sup> First of all,  
322 we observe in Table 1 (and in SI Appendix, Table S9) that,  
323 consistent with existing evidence, female respondents report  
324 more symptoms of mental health deterioration than males,  
325 during the Covid-19 period (1, 3–6). Even if some coefficients  
326 lose significance in comparison with the estimations presented  
327 in Fig. 2 (and in SI Appendix, Table S9), given the lower  
328 power of this test, we note that both Openness and Cognitive  
329 Skills (which is insignificant when we consider all together) are  
330 particularly strong predictors of mental health deterioration  
331 in female respondents.

332 We also explore differential patterns by ethnicity and age  
333 groups, by further including interaction terms for ethnicity/age,  
334 personality traits, and the indicator for the Covid-19 period  
335 (see SI Appendix Tables S22 and S23). The results in SI  
336 Appendix Table S22 suggest that B.A.M.E. (Black, Asian and  
337 minority ethnic) respondents with high Extraversion or  
338 high Openness suffer even more mental health deterioration  
339 compared to their non-B.A.M.E. counterparts.

340 In terms of heterogeneity by age groups, SI Appendix Table  
341 S23 shows that for old respondents (aged above 65) Openness is

<sup>§</sup> For expositional simplicity, we only included wave 2, 4 and 6 of the Covid-19 period, see SI Appendix Tables S20 and S21, for full results including all waves.

a significantly negative predictor of mental health deterioration compared with their younger counterpart (for whom Openness is a positive predictor), and Conscientiousness is a significantly negative predictor (for younger counterparts this becomes insignificant), during most months of the pandemic. While this is interesting, these results should be taken with caution, since personality traits and cognitive skills may not be fully reliable measures for old respondents, as discussed before.

**Table 1. Personality and Mental Health Deterioration During the Covid-19 Period for Males and Females**

	Dep. var. = GHQ-12 (0 to 12)					
	(1)	(2)	(3)	(4)	(5)	(6)
	2019 and May 2020 Female	2019 and May 2020 Male	2019 and Jul 2020 Female	2019 and Jul 2020 Male	2019 and Jan 2021 Female	2019 and Jan 2021 Male
During Covid-19 period	1.656*** (0.391)	0.863 (0.530)	-0.121 (0.444)	0.672 (0.480)	1.198** (0.505)	0.259 (0.471)
Agreeableness × during	-0.182* (0.103)	-0.199** (0.090)	-0.101 (0.126)	-0.028 (0.092)	-0.134 (0.101)	-0.149 (0.107)
Conscientious × during	-0.056 (0.099)	-0.135 (0.116)	-0.152 (0.119)	-0.118 (0.096)	-0.008 (0.096)	-0.051 (0.105)
Extraversion × during	0.187* (0.100)	0.082 (0.100)	0.102 (0.099)	-0.056 (0.086)	-0.152 (0.103)	0.063 (0.097)
Neuroticism × during	-0.019 (0.089)	-0.080 (0.101)	-0.030 (0.087)	-0.040 (0.093)	0.013 (0.093)	-0.022 (0.102)
Openness × during	0.132 (0.094)	0.158 (0.115)	0.050 (0.096)	0.129 (0.111)	0.284*** (0.091)	0.162 (0.126)
Cognitive Skills × during	0.198** (0.084)	-0.130 (0.158)	0.233*** (0.084)	-0.171 (0.152)	0.136 (0.085)	-0.074 (0.135)
N	8,806	7,943	8,806	7,943	8,806	7,943

*Notes* Personality and cognitive skills variables are standardized. All models control for individual fixed effects, job status, household income, any long term condition, month of the interview, age, region, marital status, household size and presence of children. Clustered standard errors at the individual level are in parentheses. \*\*\*, \*\*, and \* denote statistical significance at 0.01, 0.05, and 0.1 levels respectively.

To summarize our empirical findings, we can say that *During the Covid-19 period Agreeableness is a negative predictor of Mental Health deterioration; while Openness and, to a lower extent, Extraversion are positive predictors; Neuroticism is surprisingly insignificant in all specifications of the model. In female respondents, Cognitive Skills and Openness; and in B.A.M.E. respondents Openness and Extraversion are particularly strong predictors of mental health deterioration*

## Discussion

There is widespread evidence that mental health has been severely affected by the Covid-19 pandemic (e.g. 1, 3, 32, 33), and it will likely be a main issue in the post-Covid period as well (34). Therefore, it is crucial to identify the individuals that have been more affected in terms of mental health and, more generally, to shed more light on the link between personality and mental health. We believe this study provides a relevant contribution in these directions.

Our results show that Openness is a strong predictor of mental health deterioration during the pandemic period. Openness is the trait that reflects preferences for exploration and new experiences (35, 36), in fact this trait is often called “Openness to Experience”. The pandemic period is characterized by several constraints that limit the capacity of making new experience or seeking new sensations, and the fact that Openness is positively associated with mental health deterioration reflect this view. Furthermore, Openness is among the Big Five trait the one that is more consistently positively associated with intelligence (as we can observe in SI Appendix, Table S2 for our data as well), in fact Openness is sometime referred as “Intellect”. Cognitive skills like fluid intelligence and working memory seem to be related primarily to the aspect of Openness/Intellect that can be described as Intellect, which can be separated by the artistic and contemplative traits that characterize the Openness aspect (35, 37). In our main analysis we introduce cognitive skills as a regressor together with Openness, hence we can separately analyze the two aspects of Openness and Intellect. Openness is particularly strong negative predictors of mental health for women and member of the B.A.M.E. community. Interestingly, Cognitive skills are particularly strong negative predictors of mental health for women, while there is no significant effect for men.

Agreeableness reflects a tendency toward the maintenance of social stability, for this reason an individual with a more Agreeable personality can cope better in the constrained environment following the lockdown (36). However, at the same time, individuals scoring high in Agreeableness should have a general altruistic tendency, and tend to be interested in and considerate of others’ needs and feelings. In the pandemic, the knowledge that other people, either within the family or outside are suffering for various reasons, can negatively affect individuals with a more agreeable personality. Our evidence suggest that the first effect is stronger than the second.

Extraversion is, generally speaking, a trait related to sensitivity to social rewards (e.g. 38). Therefore, in an environment where social contacts are restricted, it is natural to expect that extrovert individuals are particularly negatively affected. The fact that this seems to be true only in the first part of Covid-19 period might be due to the fact that Extravert respondents managed to adapt to this situation, perhaps by using the social media platforms. In the B.A.M.E community, Extraversion is a stronger predictor of mental health deterioration than among white British.

Neuroticism is linked to higher sensitivity to negative emotions like anger, hostility or depression. For this reason Neuroticism is associate with sensibility to negative outcomes and threats (36) that should be pervasive during the current pandemic. Surprisingly, on our data we find only a weak evidence of this. A possible answer is that, given that as we can observe from Tables S4–S7 in the SI Appendix. Neuroticism is a strong negative predictor of mental health deterioration in general, and individuals with highly neurotic personality have normally experienced several negative shocks in the course of their lives, hence there might be a sort of habituation effect playing. Another possibility is that each individual does not normally experience too many symptoms of mental health deterioration, as the ones measured in the GHQ-12 questionnaire, hence respondents with an highly Neurotic personality cannot experience more symptoms than what they experienced before

428 the pandemic period.

429 The effects of Extraversion and Openness and the lack of a  
430 strong effect of Neuroticism on mental health are consistent  
431 with (39) field-experiment results. They show that subjects  
432 experiencing larger disruptions to their life-style behaviors,  
433 arguably subjects with a more open and extrovert personality,  
434 faced the larger increase in depression symptoms, and that  
435 the standard predictors of depression, like a highly Neurotic  
436 personality, were less important.

437 Conscientiousness reflects a tendency to maintain motiva-  
438 tional stability. For this reason, a conscientious individual can  
439 overcome better the practical constraints and manage better  
440 the negative feelings due to the pandemics. On the other hand,  
441 conscientious individuals have preferences to make long-term  
442 ambitious plans, something impossible to achieve in an highly  
443 uncertain environment, hence there is no reason to expect a  
444 positive or negative effect.

445 Using a convenience sample of 484 University of Vermont  
446 fist year UG student and considering as a baseline January  
447 2020, (8) analyze how personality traits interact with the  
448 Covid period to affect some well-being indicators. They find  
449 a negative effects of Extraversion and Openness as well, and  
450 in line with out findings they do not find a negative effect of  
451 Neuroticism (they actually report a positive effect). Differently  
452 from us, the effect of Agreeableness seems negative. While  
453 we are not aware of any particular coronavirus restrictions  
454 in Vermont in January 2020, the expectations that a world  
455 pandemic was eventually declared was widespread, so it is  
456 not possible to rule out that the baseline used by (8) was  
457 completely unaffected.

458 (10) use a small convenience sample of 51 German individu-  
459 als in a panel over three consecutive weeks within the Covid-19  
460 period. They show that Extraverts suffer from limitations and  
461 benefit from relaxation, and individuals with high Neuroticism  
462 have not shown any change in dealing with the restrictions  
463 over time. The fact that both (8) and (10) do not find any  
464 negative effect on Neuroticism as we do is remarkable.

465 Furthermore, (9) and (7) analyze the link between person-  
466 ality traits and psychological well-being with cross-sectional  
467 data. Hence, as we argued above, their designs do not allow to  
468 control for individual fixed effects and it is comparable with  
469 what we do in our sanity check (SI appendix, Tables S4–S7).  
470 (9) surveyed a convenience sample of Canadian Population using  
471 the online platform Qualtrics in June/July 2020. Similarly  
472 as we do in our sanity checks, they find a negative effect of  
473 Neuroticism and a positive effect of Extraversion. (7) use a  
474 convenience sample of Japan population recruited through Ya-  
475 hoo! Crowdsourcing service and conducted in April 2020 and  
476 they find that Neuroticism affects negatively wellbeing indica-  
477 tors as we do in our sanity check. As we argued, controlling  
478 for individual fixed effect avoids potential confounding factors  
479 and allows to more precisely identify the effect Covid-19 on  
480 mental health.

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1. James Banks and Xiaowei Xu. The mental health effects of the first two months of lockdown and social distancing during the Covid-19 pandemic in the UK. IFS working paper w20/16, Institute for Fiscal Studies, 2020.
2. Carol Graham, Barton H Hamilton, Yung Chun, Stephen Roll, Will Ross, Karen E Joynt-Maddox, Michal Grinstein-Weiss, et al. Coping with COVID-19: Implications of differences in resilience across racial groups for mental health and well-being. HCEO working paper 2020-067, Human Capital and Economic Opportunity Global Working Group, 2020.
3. Michael Daly, Angelina R Sutin, and Eric Robinson. Longitudinal changes in mental health and the covid-19 pandemic: Evidence from the uk household longitudinal study. *Psychological Medicine*, .:1–10, 2020.
4. Apostolos Davillas and Andrew M Jones. The COVID-19 pandemic and its impact on inequality of opportunity in psychological distress in the UK. ISEER working paper 2020-07, Institute for Social and Economic Research, University of Essex, 2020.
5. Ben Etheridge and Lisa Spantig. The gender gap in mental well-being during the Covid-19 outbreak: Evidence from the UK. ISEER working paper 2020-08, 2020.
6. Eugenio Proto and Climent Quintana-Domeque. Covid-19 and mental health deterioration by ethnicity and gender in the uk. *PLoS One*, 16(1):e0244419, 2021.
7. Kun Qian and Tetsukazu Yahara. Mentality and behavior in covid-19 emergency status in japan: Influence of personality, morality and ideology. *PLoS One*, 15(7):e0235883, 2020.
8. David C Rettew, Ellen W McGinnis, William Copeland, Hilary Y Nardone, Yang Bai, Jeff Rettew, Vinay Devadenam, and James J Hudziak. Personality trait predictors of adjustment during the covid pandemic among college students. *PLoS One*, 16(3):e0248895, 2021.
9. Anahita Shokrkon and Elena Nicoladis. How personality traits of neuroticism and extroversion predict the effects of the covid-19 on the mental health of Canadians. *PLoS One*, 16(5):e0251097, 2021.
10. Martin Weiß, Johannes Rodrigues, and Johannes Hewig. BIG 5 personality factors in relation to coping with contact restrictions during the COVID-19 pandemic: An explorative analysis. Preprint, PsychArchives, 2020. URL <http://dx.doi.org/10.23668/psycharchives.3484>.
11. Lewis R Goldberg. The structure of phenotypic personality traits. *American Psychologist*, 48(1):26, 1993.
12. JM Digman. Child personality and temperament: Does the five-factor model embrace both domains. In Charles F. Halverson, Gedolph A. Kohnstamm, and Roy P. Martin, editors, *The developing structure of temperament and personality from infancy to adulthood*, pages 323–338. Psychology Press, 2014. ISBN 9781317781790.
13. Kristian E Markon, Robert F Krueger, and David Watson. Delineating the structure of normal and abnormal personality: an integrative hierarchical approach. *Journal of Personality and Social Psychology*, 88(1):139, 2005.
14. Paul T Costa Jr and Robert R McCrae. *The Revised NEO Personality Inventory (NEO-PI-R)*. Sage Publications, Inc, 2008.
15. David Watson and Lee Anna Clark. Introduction to the special issue on personality and psychopathology. *Journal of Abnormal Psychology*, 103(1):3, 1994.
16. Robert F Krueger and Jennifer L Tackett. Personality and psychopathology: Working toward the bigger picture. *Journal of Personality Disorders*, 17(2: Special issue):109–128, 2003.
17. Lee Anna Clark. Temperament as a unifying basis for personality and psychopathology. *Journal of Abnormal Psychology*, 114(4):505, 2005.
18. Roman Kotov, Wakiza Gamez, Frank Schmidt, and David Watson. Linking “big” personality traits to anxiety, depressive, and substance use disorders: a meta-analysis. *Psychological Bulletin*, 136(5):768, 2010.
19. Daniel N Klein, Roman Kotov, and Sara J Bufferd. Personality and depression: explanatory models and review of the evidence. *Annual Review of Clinical Psychology*, 7:269, 2011.
20. David Watson and Lee Anna Clark. On traits and temperament: General and specific factors of emotional experience and their relation to the five-factor model. *Journal of Personality*, 60(2):441–476, 1992.
21. Ed Diener and Richard E. Lucas. Personality and subjective well-being. In *Well-Being: The Foundations of Hedonic Psychology*, pages 213–229. Russell Sage Foundation, New York, NY, 1999. ISBN 978-0-87154-424-7.
22. Christopher J Boyce and Alex M Wood. Personality and the marginal utility of income: Personality interacts with increases in household income to determine life satisfaction. *Journal of Economic Behavior & Organization*, 78(1-2):183–191, 2011.
23. Eugenio Proto and Aldo Rustichini. Life satisfaction, income and personality. *Journal of Economic Psychology*, 48:17–32, 2015.
24. University of Essex, Institute for Social and Economic Research. COVID-19 Study, 2020. UK Data Service. SN: 8644, 2020.
25. University of Essex, Institute for Social and Economic Research, NatCen Social Research, Kantar Public. Understanding Society: Waves 1-10, 2009-2019 and Harmonised BHPS: Waves 1-18, 1991-2009. UK Data Service. SN: 6614, 2020.
26. David Paul Goldberg and Paul Williams. *A User's Guide to the General Health Questionnaire: GHQ*. GL Assessment, London, 1988. ISBN 978-0-7005-1182-2 978-0-7087-1756-1.
27. Samuel D Gosling, Peter J Rentfrow, and William B Swann Jr. A very brief measure of the big-five personality domains. *Journal of Research in Personality*, 37(6):504–528, 2003.
28. Verónica Benet-Martínez and Oliver P John. Los cinco grandes across cultures and ethnic groups: Multitrait-multimethod analyses of the Big Five in Spanish and English. *Journal of Personality and Social Psychology*, 75(3):729, 1998.
29. Lex Borghans, Angela Lee Duckworth, James J Heckman, and Bas Ter Weel. The economics and psychology of personality traits. *Journal of Human Resources*, 43(4):972–1059, 2008.
30. Deborah A Cobb-Clark and Stefan Schurer. The stability of big-five personality traits. *Economics Letters*, 115(1):11–15, 2012.
31. Stephanie McFall. Understanding Society: UK Household Longitudinal Study: Cognitive ability measures. Technical report, Institute for Social and Economic Research, University of

- 573 Essex, 2013.
- 574 32. Abel Brodeur, Andrew E Clark, Sarah Fleche, and Nattavudh Powdthavee. Covid-19, lock-  
575 downs and well-being: Evidence from google trends. *Journal of Public Economics*, 193:  
576 104346, 2021.
- 577 33. Catherine K Ettman, Salma M Abdalla, Gregory H Cohen, Laura Sampson, Patrick M Vivier,  
578 and Sandro Galea. Prevalence of depression symptoms in us adults before and during the  
579 covid-19 pandemic. *JAMA Network Open*, 3(9):e2019686–e2019686, 2020.
- 580 34. L Akinin, J-E De Neve, E Dunn, D Fancourt, E Goldberg, JF Helliwell, SP Jones, E Karam,  
581 R Layard, S Lyubomirsky, A Rzepa, S Saxena, EM Thornton, TJ VanderWeele, AV Whillans,  
582 J Zaki, O Karadag Caman, and Y Ben Amor. Mental health during the first year of the  
583 COVID-19 pandemic: A review and recommendations for moving forward. *Perspectives on*  
584 *Psychological Science*, In Press, 2021.
- 585 35. Colin G DeYoung, Jordan B Peterson, and Daniel M Higgins. Sources of openness/intellect:  
586 Cognitive and neuropsychological correlates of the fifth factor of personality. *Journal of Per-*  
587 *sonality*, 73(4):825–858, 2005.
- 588 36. Colin G. DeYoung and Jeremy R. Gray. *Personality neuroscience: explaining individual differ-*  
589 *ences in affect, behaviour and cognition*, page 323–346. Cambridge Handbooks in Psychol-  
590 ogy. Cambridge University Press, 2009.
- 591 37. Colin G DeYoung, Lena C Quilty, and Jordan B Peterson. Between facets and domains: 10  
592 aspects of the big five. *Journal of Personality and Social Psychology*, 93(5):880, 2007.
- 593 38. Richard A Depue and Jeannine V Morrone-Strupinsky. A neurobehavioral model of affiliative  
594 bonding: Implications for conceptualizing a human trait of affiliation. *Behavioral and Brain*  
595 *Sciences*, 28(3):313–349, 2005.
- 596 39. Osea Giuntella, Kelly Hyde, Silvia Saccardo, and Sally Sadoff. Lifestyle and mental health  
597 disruptions during covid-19. *Proceedings of the National Academy of Sciences*, 118(9), 2021.

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## 2 **Supplementary Information for**

### 3 **Covid-19 and Mental Health of Individuals with Different Personalities**

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#### 7 **This PDF file includes:**

- 8     Supplementary text
- 9     Figs. S1 to S2 (not allowed for Brief Reports)
- 10    Tables S1 to S23 (not allowed for Brief Reports)
- 11    SI References

## 12 Supporting Information Text

### 13 1. Definition of Key Variables

14 This section provides details on how these key variables are defined: GHQ-12, Big Five personality, and cognitive skills.

15 **GHQ-12 Questionnaire.** The GHQ module contains the following questions for the GHQ-12 Questionnaire:

- 16 1. scghqa [GHQ: concentration] The next questions are about how you have been feeling over the last few weeks. Have you  
17 recently been able to concentrate on whatever you're doing? 1. Better than usual 2. Same as usual 3. Less than usual 4.  
18 Much less than usual
- 19 2. scghqb [GHQ: loss of sleep] Have you recently lost much sleep over worry? 1. Not at all 2. No more than usual 3. Rather  
20 more than usual 4. Much more than usual
- 21 3. scghqc [GHQ: playing a useful role] Have you recently felt that you were playing a useful part in things? 1. More so than  
22 usual 2. Same as usual 3. Less so than usual 4. Much less than usual
- 23 4. scghqd [GHQ: capable of making decisions] Have you recently felt capable of making decisions about things? 1. More so  
24 than usual 2. Same as usual 3. Less so than usual 4. Much less capable
- 25 5. scghqe [GHQ: constantly under strain] Have you recently felt constantly under strain? 1. Not at all 2. No more than  
26 usual 3. Rather more than usual 4. Much more than usual
- 27 6. scghqf [GHQ: problem overcoming difficulties] Have you recently felt you couldn't overcome your difficulties? 1. Not at  
28 all 2. No more than usual 3. Rather more than usual 4. Much more than usual
- 29 7. scghqg [GHQ: enjoy day-to-day activities] Have you recently been able to enjoy your normal day-to-day activities? 1.  
30 More so than usual 2. Same as usual 3. Less so than usual 4. Much less than usual
- 31 8. scghqh [GHQ: ability to face problems] Have you recently been able to face up to problems? 1. More so than usual 2.  
32 Same as usual 3. Less able than usual 4. Much less able
- 33 9. scghqi [GHQ: unhappy or depressed] Have you recently been feeling unhappy or depressed? 1. Not at all 2. No more  
34 than usual 3. Rather more than usual 4. Much more than usual
- 35 10. scghqj [GHQ: losing confidence] Have you recently been losing confidence in yourself? 1. Not at all 2. No more than  
36 usual 3. Rather more than usual 4. Much more than usual
- 37 11. scghqk [GHQ: believe worthless] Have you recently been thinking of yourself as a worthless person? 1. Not at all 2. No  
38 more than usual 3. Rather more than usual 4. Much more than usual
- 39 12. scghql [GHQ: general happiness] Have you recently been feeling reasonably happy, all things considered? 1. More so than  
40 usual 2. About the same as usual 3. Less so than usual 4. Much less than usual The GHQ-12 range goes from 0-36. This  
41 range is obtained by subtracting 1 to the values given in each question. Thus, the values in each question are re-coded  
42 from 1-4 to 0-3.

43 **The "Big Five" in the Understanding Society Survey.** The big five personality traits are Agreeableness (A), Conscientiousness  
44 (C), Extraversion (E), Neuroticism (N), Openness (O). They are assessed with the following questions:

45 I see myself as someone who:

- 46 1. (A) Is sometimes rude to others (*reverse-scored*).
- 47 2. (C) Does a thorough job.
- 48 3. (E) Is talkative.
- 49 4. (N) Worries a lot.
- 50 5. (O) Is original, comes up with new ideas.
- 51 6. (A) Has a forgiving nature.
- 52 7. (C) Tends to be lazy (*reverse-scored*).
- 53 8. (E) Is outgoing, sociable.
- 54 9. (N) Gets nervous easily.
- 55 10. (O) Values artistic, aesthetic experiences.

- 56 11. (A) Is considerate and kind to almost everyone.  
57 12. (C) Does things efficiently.  
58 13. (E) Is reserved (*reverse-scored*).  
59 14. (N) Is relaxed, handles stress well (*reverse-scored*).  
60 15. (O) Has an active imagination.

61 **The Cognitive Skills in the Understanding Society Survey. Episodic Memory** or Memory: “The computer will now read a  
62 set of 10 words. I would like you to remember as many as you can. We have purposely made the list long so it will be difficult  
63 for anyone to remember all the words. Most people remember just a few. Please listen carefully to the set of words as they  
64 cannot be repeated. When it has finished, I will ask you to recall aloud as many of the words as you can, in any order. Is this  
65 clear? Now please tell me the words you can remember.” Respondents give the words in any order. The interviewer codes each  
66 correct response... For the delayed word recall test, after the Number Series test, respondents were again asked to remember  
67 the words from the list. The interviewer codes each correct response.

68 **Working Memory** or Serial 7 Subtraction: “Now let’s try some subtraction of numbers. One hundred minus 7 equals  
69 what?’ [Interviewer records the number.] ‘And take 7 away from that?’ [records number] ‘And take 7 away from that.’ The  
70 respondent gives numeric answers for successive trials, five in all.”

71 **Verbal Fluency**: “Now, I would like you to name as many animals as you can. You have one-minute, so name them as  
72 quickly as possible. We will begin when you say the first animal. If you are unsure of anything please ask me now as I am  
73 unable to answer questions once the minute starts”

74 **Problem Solving** or Numerical Ability: “Next I would like to ask you some questions to understand how people use  
75 numbers in everyday life. If CATI, the interviewer added, You might want to have a pencil and paper handy to help you  
76 answer the following items The measure of numeric ability asks respondents up to five questions that are graded in complexity  
77 (Table 2 at page 14 of 1, displays the questions and how they are administered)”

78 **Fluid Reasoning** or Number Series: Individuals are randomly assigned to Set 1 or Set 2 (of items) within households. For  
79 this test, respondents use a pencil and paper to write down the number sequences as read by the interviewer. The number  
80 series consists of several numbers with a blank number in the series. The respondent will be asked which number goes in the  
81 blank (see page 11 of 1, for more details)

## 82 2. Sanity Check of the data

83 The results reported in Table S4 represent a sanity check for our data. We will argue now that the results reported in this  
84 table are consistent with the findings in the existing mental health literature. Table S4 presents the correlations between  
85 mental health, as measured by GHQ-12 caseness, and some individual characteristics based on the pre-Covid wave of data. We  
86 consider 3 different specifications of the model. In the model reported in column 1, we include personality traits as the only  
87 regressors. In column 2, we include controls for gender and cognitive skills. In column 3, we further add a number of control  
88 variables that will be used for the estimation of our main model.

89 First of all, from columns 2 and 3, we note that female respondents report more symptoms than men. As it is well known,  
90 women tend to report higher level of depression and anxiety.\* For columns 2 and 3, we do not observe any significant correlation  
91 between cognitive skills and mental health: to the best of our knowledge we do not know any systematic link between these  
92 two variables. Considering now personality traits, the correlations reported in Table S4 are broadly consistent with the existing  
93 literature on mental health and personality. There is a strong positive effect of Neuroticism on GHQ-12 (roughly, an increase  
94 in one standard deviation in Neuroticism is associated with 0.7 more symptoms). Past studies also find negative effects of  
95 Conscientiousness on mental health and, to a lower extent, of Extraversion; while Agreeableness is largely uncorrelated with  
96 mental health. Table 4 in (3) report these effects on anxiety and depression (see also 4). From (3) we note that the effect of  
97 Neuroticism is far stronger than Conscientiousness and Extraversion, and the effects of these two last traits are comparable in  
98 magnitude, which is consistent with the results reported in Table S4, especially in the specification reported in column 3.

99 Correlations in Table S4 are also consistent with the links observed between personality traits and self-reported subjective  
100 wellbeing (or happiness as it is frequently called) (5, 6), that Neuroticism strongly negatively correlates, while Conscientiousness  
101 and Extraversion usually positively correlate with subjective wellbeing, and that the latter two come with similar magnitudes  
102 which are much smaller in absolute terms compared to that of Neuroticism (see e.g. Table 5 of 7). The only exception in the  
103 comparison with the existing literature on mental health is the significant correlation between GHQ-12 and Openness that we  
104 can observe in Table S4. A possible explanation is that mental health studies as the ones reviewed in (3) consider serious  
105 disorders, while GHQ-12 is better suited for detecting minor psychiatric disorders (which may signal the beginning of serious  
106 disorders). This explanation is supported by the frequently observed negative associations between Openness and subjective  
107 wellbeing (see e.g. Table 5 of 7).

108 It is also important to note that the coefficients reported in Table S4 on Openness, albeit statistically significant, are much  
109 smaller than the one we find on Neuroticism. In Table S5, we present similar estimations for each wave we use in this study; In  
110 Table S6, we present similar estimations for GHQ-36 instead of GHQ-12; and in Table S7, we run the same regressions by  
111 excluding all respondents older than 60 and younger than 27.

\*Men and women experience different types of mental health problems. Men exhibit more externalizing disorders such as substance abuse and antisocial behavior (see e.g 2).

112 **3. Additional Results**

113 This section provides additional tables and figures that are not included in the main text.

**Table S1. Sample size and key characteristics at different stages of sample selection**

	(1) Balance panel based on Covid Studies 1–7 N = 8947		(2) With previous information from Wave 3 N = 6928		(3) With previous information from Wave 9 N = 6727		(4) Selected sample after dropping missing values N = 5583		(5) Difference = (1)–(4)		(6) Difference = (3)–(4)	
	N	Mean (SD)	N	Mean (SD)	N	Mean (SD)	N	Mean (SD)	Diff. (SE)	p-value	Diff. (SE)	p-value
<i>Personality traits</i>												
Agreeableness	7086	5.614 (0.978)	6928	5.611 (0.974)	6727	5.611 (0.973)	5583	5.598 (0.971)	0.016 (0.017)	0.353	0.013 (0.018)	0.475
Conscientiousness	7087	5.594 (0.993)	6928	5.591 (0.992)	6727	5.590 (0.990)	5583	5.589 (0.997)	0.005 (0.018)	0.764	0.001 (0.018)	0.973
Extraversion	7087	4.518 (1.310)	6928	4.516 (1.306)	6727	4.516 (1.305)	5583	4.499 (1.302)	0.018 (0.023)	0.436	0.016 (0.024)	0.489
Neuroticism	7087	3.558 (1.396)	6928	3.556 (1.394)	6727	3.553 (1.395)	5583	3.539 (1.392)	0.019 (0.025)	0.450	0.014 (0.025)	0.580
Openness	7086	4.610 (1.204)	6928	4.617 (1.197)	6727	4.618 (1.197)	5583	4.614 (1.198)	−0.004 (0.021)	0.859	0.004 (0.022)	0.867
<i>Mental health</i>												
GHQ12 (Case) <sup>a</sup>	8871	2.588 (3.164)	6882	2.515 (3.110)	6682	2.494 (3.095)	5583	2.420 (3.045)	0.168*** (0.053)	0.001	0.074 (0.056)	0.185
GHQ12 (Scale) <sup>a</sup>	8871	12.138 (5.870)	6882	11.968 (5.786)	6682	11.931 (5.761)	5583	11.793 (5.663)	0.345*** (0.098)	0.000	0.138 (0.103)	0.183
<i>Socio-economic characteristics</i>												
Female	8947	0.585 (0.493)	6928	0.589 (0.492)	6727	0.589 (0.492)	5583	0.577 (0.494)	0.008 (0.008)	0.353	0.012 (0.009)	0.191
Year of birth <sup>b</sup>	8944	1964.051 (15.622)	6928	1961.496 (13.715)	6727	1961.319 (13.667)	5583	1960.394 (13.323)	3.656*** (0.243)	0.000	0.925*** (0.244)	0.000
BAME <sup>c</sup>	8772	0.117 (0.322)	6885	0.087 (0.282)	6688	0.086 (0.280)	5583	0.081 (0.273)	0.036*** (0.005)	0.000	0.005 (0.005)	0.331
Qualification: degree	8593	0.366 (0.482)	6784	0.370 (0.483)	6727	0.371 (0.483)	5583	0.371 (0.483)	−0.006 (0.008)	0.473	0.000 (0.009)	0.973
Qualification: other higher degree	8593	0.144 (0.351)	6784	0.150 (0.357)	6727	0.150 (0.357)	5583	0.151 (0.358)	−0.007 (0.006)	0.245	−0.001 (0.006)	0.881
Qualification: A-levels	8593	0.199 (0.399)	6784	0.192 (0.394)	6727	0.192 (0.394)	5583	0.185 (0.388)	0.014** (0.007)	0.037	0.007 (0.007)	0.341
Qualification: GCSE	8593	0.179 (0.383)	6784	0.181 (0.385)	6727	0.181 (0.385)	5583	0.181 (0.385)	−0.003 (0.007)	0.704	−0.001 (0.007)	0.943
Qualification: other	8593	0.066 (0.249)	6784	0.067 (0.250)	6727	0.067 (0.250)	5583	0.071 (0.256)	−0.005 (0.004)	0.298	−0.004 (0.005)	0.419
Qualification: none	8593	0.041 (0.199)	6784	0.039 (0.194)	6727	0.039 (0.193)	5583	0.040 (0.196)	0.001 (0.003)	0.751	−0.001 (0.004)	0.708
Qualification: missing	8593	0.005 (0.074)	6784	0.001 (0.024)	6727	0.001 (0.024)	5583	0.001 (0.023)	0.005*** (0.001)	0.000	0.000 (0.000)	0.894
Self-employed	8593	0.076 (0.264)	6784	0.079 (0.270)	6727	0.079 (0.270)	5583	0.079 (0.270)	−0.003 (0.005)	0.452	0.000 (0.005)	0.936
Employee	8593	0.504 (0.500)	6784	0.500 (0.500)	6727	0.499 (0.500)	5583	0.482 (0.500)	0.022*** (0.009)	0.009	0.017* (0.009)	0.063
Unemployed	8593	0.021 (0.144)	6784	0.018 (0.131)	6727	0.017 (0.131)	5583	0.015 (0.122)	0.006*** (0.002)	0.010	0.002 (0.002)	0.343
Retired	8593	0.311 (0.463)	6784	0.340 (0.474)	6727	0.341 (0.474)	5583	0.364 (0.481)	−0.053*** (0.008)	0.000	−0.023*** (0.009)	0.008
Student	8593	0.023 (0.149)	6784	0.003 (0.058)	6727	0.003 (0.058)	5583	0.003 (0.050)	0.020*** (0.002)	0.000	0.001 (0.001)	0.351
Other employment	8593	0.065 (0.246)	6784	0.060 (0.237)	6727	0.059 (0.237)	5583	0.057 (0.232)	0.008* (0.004)	0.062	0.003 (0.004)	0.555
Employment missing	8593	0.001 (0.024)	6784	0.000 (0.017)	6727	0.000 (0.012)	5583	0.000 (0.013)	0.000 (0.000)	0.202	0.000 (0.000)	0.896

*Notes* This table presents the sample size and key characteristics for different stages of sample selection. Columns (1)–(4) report the number of observations, mean and standard deviation (SD) for each stage. Columns (5) and (6) report the difference in means between two stages, the standard errors, and the *p*-value for a *t*-test of mean comparison. \*\*\*, \*\*, and \* denote statistical significance at 0.01, 0.05, and 0.1 levels respectively.

<sup>a</sup> As measured in April 2020.

<sup>b</sup> Respondents are aged 16+ in column (1), and 23+ in columns (2)–(4).

<sup>c</sup> BAME refers to a binary indicator of black, Asian and minority ethnicity. The reference group is British white.

**Table S2. Summary statistics**

	Mean	SD	Min.	Max
<i>Mental health</i>				
GHQ 12 (Case)	2.028	3.113	0.0	12.0
GHQ 12 (Scale)	11.614	5.529	0.0	36.0
<i>Personality and Cognitive Skills (standardised)</i>				
Agreeableness	0.001	0.994	-4.7	1.4
Conscientiousness	0.002	0.998	-4.6	1.4
Extraversion	-0.005	0.997	-2.7	1.9
Neuroticism	-0.004	0.999	-1.8	2.5
Openness	0.007	0.994	-3.0	2.0
Cognitive ability	0.003	0.996	-5.9	2.8
<i>Socio-economic characteristics</i>				
Female	0.580	0.494	0.0	1.0
Age (years)	58.989	13.479	23.0	93.0
Age squared/100	36.614	15.390	5.3	86.5
White British	0.919	0.273	0.0	1.0
Non-BIP (Other white, Mixed, Black, Chinese, Arab)	0.064	0.244	0.0	1.0
Bangladeshi, Indian and Pakistani (South Asian)	0.017	0.131	0.0	1.0
Qualification: degree	0.373	0.484	0.0	1.0
Qualification: higher degree	0.149	0.356	0.0	1.0
Qualification: A-levels	0.188	0.391	0.0	1.0
Qualification: GCSE	0.181	0.385	0.0	1.0
Qualification: other	0.068	0.252	0.0	1.0
Qualification: none	0.040	0.196	0.0	1.0
Qualification: missing	0.001	0.026	0.0	1.0
Never married (2019)	0.106	0.308	0.0	1.0
Married/cohabiting (2019)	0.749	0.434	0.0	1.0
London	0.067	0.250	0.0	1.0
Wales	0.056	0.229	0.0	1.0
Scotland	0.095	0.294	0.0	1.0
Northern Ireland	0.036	0.187	0.0	1.0
England (excluding London)	0.746	0.435	0.0	1.0
Month FE: Jan	0.088	0.284	0.0	1.0
Month FE: Feb	0.079	0.270	0.0	1.0
Month FE: Mar	0.087	0.281	0.0	1.0
Month FE: Apr	0.078	0.268	0.0	1.0
Month FE: May	0.086	0.280	0.0	1.0
Month FE: Jun	0.075	0.264	0.0	1.0
Month FE: Jul	0.079	0.270	0.0	1.0
Month FE: Aug	0.094	0.291	0.0	1.0
Month FE: Sep	0.078	0.268	0.0	1.0
Month FE: Oct	0.098	0.297	0.0	1.0
Month FE: Nov	0.087	0.282	0.0	1.0
Month FE: Dec	0.072	0.258	0.0	1.0
Any long-term condition	0.580	0.494	0.0	1.0
Employment: not working	0.468	0.499	0.0	1.0
Employment: employee	0.429	0.495	0.0	1.0
Employment: self-employed	0.074	0.262	0.0	1.0
Employment: both	0.016	0.126	0.0	1.0
Employment: furlough	0.012	0.111	0.0	1.0
Employment: retired	0.351	0.477	0.0	1.0
Employment: student	0.003	0.054	0.0	1.0
Household size	2.380	1.084	1.0	11.0
Has children	0.183	0.386	0.0	1.0
Log HH income per capita	5.934	2.766	0.0	11.1
Income missing	0.144	0.351	0.0	1.0
<i>N</i>	49,168			

Source: Authors' calculation based on data from Understanding Society.

**Table S3. Correlation matrix**

	Variable						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Agreeableness	Conscientiousness	Extraversion	Openess	Neuroticism	Female	Cognitive ability
(1)							
Agreeableness	1						
Conscientiousness	0.305***	1					
Extraversion	0.172***	0.192***	1				
Openness	0.188***	0.167***	0.231***	1			
Neuroticism	-0.0932***	-0.146***	-0.213***	-0.104***	1		
Female	0.163***	0.134***	0.121***	-0.0755***	0.187***	1	
Cognitive ability	-0.0849***	-0.0223	-0.0214	0.130***	-0.0590***	-0.117***	1

Notes \*\*\*, \*\*, and \* denote statistical significance at 0.01, 0.05, and 0.1 levels respectively.

**Table S4. Personality and mental health in the pre-Covid-19 wave**

	Dep. var. = GHQ12 (0 to 12)		
	(1)	(2)	(3)
	Wave 9 2017–19	Wave 9 2017–19	Wave 9 2017–19
Female		0.312*** (0.074)	0.133* (0.074)
Agreeableness	0.047 (0.040)	0.021 (0.041)	0.025 (0.039)
Conscientiousness	-0.108*** (0.040)	-0.126*** (0.040)	-0.073* (0.039)
Extraversion	-0.036 (0.038)	-0.062 (0.038)	-0.066* (0.037)
Neuroticism	0.748*** (0.039)	0.709*** (0.041)	0.610*** (0.040)
Openness	0.082** (0.039)	0.108*** (0.040)	0.083** (0.039)
Cognitive ability		-0.036 (0.036)	-0.002 (0.039)
<i>N</i>	6,146	6,146	6,146

*Notes* Personality and cognitive skills variables are standardized. In the model estimated in column 3, control variables for job status, household income, any long term condition, month of the interview, age, region, marital status, household size and presence of children are included in the estimation but omitted from reporting. Robust standard errors are in parentheses. \*\*\*, \*\*, and \* denote statistical significance at 0.01, 0.05, and 0.1 levels respectively.

**Table S5. Personality and mental health in each wave**

	Dep. var. = GHQ12 (from 0 to 12)							
	(1) 2017–19	(2) Apr 2020	(3) May 2020	(4) Jun 2020	(5) Jul 2020	(6) Sep 2020	(7) Nov 2020	(8) Jan 2021
Female	0.133* (0.074)	0.863*** (0.079)	0.691*** (0.080)	0.548*** (0.085)	0.392*** (0.079)	0.562*** (0.080)	0.643*** (0.087)	0.691*** (0.086)
Agreeableness	0.025 (0.039)	0.004 (0.042)	-0.043 (0.043)	-0.040 (0.045)	0.024 (0.042)	0.034 (0.043)	-0.029 (0.045)	-0.066 (0.045)
Conscientiousness	-0.073* (0.039)	-0.071* (0.041)	-0.095** (0.042)	-0.120*** (0.044)	-0.108*** (0.041)	-0.169*** (0.042)	-0.147*** (0.044)	-0.107** (0.045)
Extraversion	-0.066* (0.037)	-0.024 (0.041)	0.012 (0.041)	-0.027 (0.042)	-0.072* (0.040)	-0.032 (0.041)	-0.050 (0.044)	-0.072* (0.043)
Neuroticism	0.610*** (0.040)	0.632*** (0.042)	0.642*** (0.043)	0.703*** (0.045)	0.600*** (0.042)	0.621*** (0.042)	0.637*** (0.045)	0.689*** (0.046)
Openness	0.083** (0.039)	0.108*** (0.042)	0.165*** (0.042)	0.227*** (0.045)	0.170*** (0.042)	0.193*** (0.042)	0.201*** (0.044)	0.219*** (0.045)
Cognitive ability	-0.002 (0.039)	0.008 (0.042)	0.032 (0.042)	0.024 (0.045)	0.031 (0.041)	0.015 (0.043)	0.023 (0.045)	-0.005 (0.046)
<i>N</i>	6,146	6,146	6,146	6,146	6,146	6,146	6,146	6,146

*Notes* Personality and cognitive skills variables are standardized. All models control for job status, household income, any long term condition, month of the interview, age, region, marital status, household size and presence of children. Robust standard errors are in parentheses. \*\*\*, \*\*, and \* denote statistical significance at 0.01, 0.05, and 0.1 levels respectively.

**Table S6. Personality and mental health (GHQ-12 scale) in each wave**

	Dep. var. = GHQ12 scale (from 0 to 36)							
	(1) 2017–19	(2) Apr 2020	(3) May 2020	(4) Jun 2020	(5) Jul 2020	(6) Sep 2020	(7) Nov 2020	(8) Jan 2021
Female	0.303** (0.129)	1.485*** (0.145)	1.090*** (0.143)	0.900*** (0.148)	0.802*** (0.135)	0.935*** (0.137)	1.071*** (0.145)	1.169*** (0.146)
Agreeableness	0.029 (0.071)	-0.006 (0.079)	-0.037 (0.078)	-0.069 (0.081)	-0.003 (0.072)	0.050 (0.074)	-0.015 (0.075)	-0.107 (0.079)
Conscientiousness	-0.209*** (0.067)	-0.217*** (0.075)	-0.276*** (0.074)	-0.268*** (0.077)	-0.250*** (0.070)	-0.357*** (0.071)	-0.320*** (0.074)	-0.266*** (0.076)
Extraversion	-0.161** (0.064)	-0.114 (0.076)	-0.009 (0.075)	-0.099 (0.074)	-0.174** (0.070)	-0.147** (0.069)	-0.159** (0.074)	-0.173** (0.074)
Neuroticism	1.446*** (0.067)	1.467*** (0.077)	1.483*** (0.077)	1.583*** (0.078)	1.421*** (0.072)	1.431*** (0.072)	1.516*** (0.076)	1.537*** (0.078)
Openness	0.044 (0.069)	0.100 (0.078)	0.181** (0.076)	0.282*** (0.078)	0.195*** (0.072)	0.263*** (0.073)	0.264*** (0.077)	0.282*** (0.078)
Cognitive ability	-0.026 (0.069)	-0.104 (0.078)	-0.032 (0.076)	-0.044 (0.080)	0.061 (0.072)	-0.023 (0.073)	-0.017 (0.077)	-0.088 (0.079)
<i>N</i>	6,146	6,146	6,146	6,146	6,146	6,146	6,146	6,146

*Notes* Personality and cognitive skills variables are standardized. All models control for job status, household income, any long term condition, month of the interview, age, region, marital status, household size and presence of children. Robust standard errors are in parentheses. \*\*\*, \*\*, and \* denote statistical significance at 0.01, 0.05, and 0.1 levels respectively.

**Table S7. Personality and mental health in each wave, excluding over 60s and under 27s**

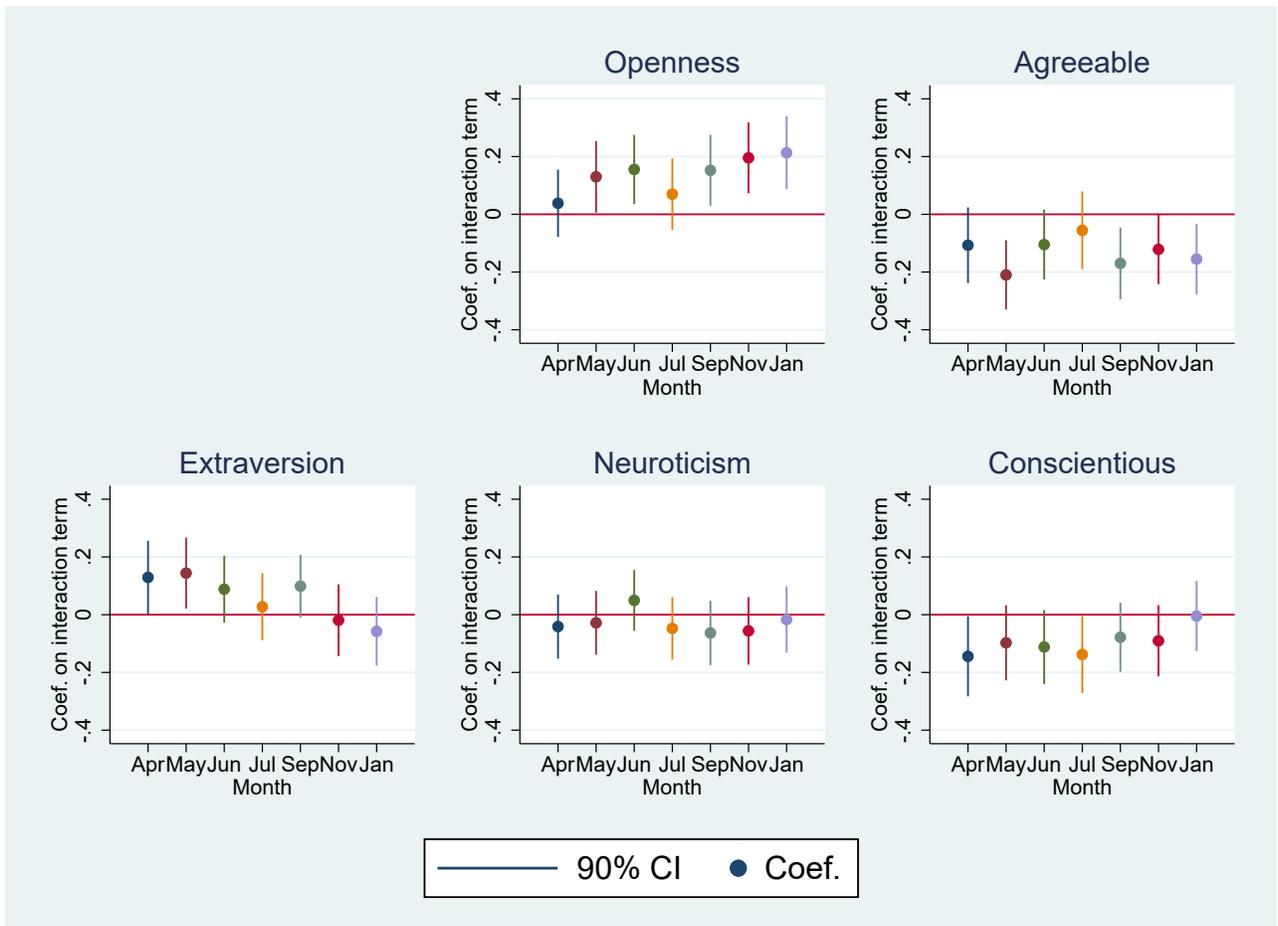
	Dep. var. = GHQ12 (from 0 to 12)							
	(1) 2018/19	(2) Apr 2020	(3) May 2020	(4) Jun 2020	(5) Jul 2020	(6) Sep 2020	(7) Nov 2020	
Female	0.132 (0.118)	1.044*** (0.122)	0.768*** (0.127)	0.656*** (0.136)	0.334** (0.130)	0.642*** (0.129)	0.792*** (0.137)	0.743*** (0.136)
Agreeableness	0.013 (0.059)	-0.015 (0.062)	-0.082 (0.064)	-0.075 (0.067)	0.029 (0.063)	0.052 (0.064)	-0.077 (0.067)	-0.121* (0.066)
Conscientiousness	-0.136** (0.063)	-0.068 (0.063)	-0.156** (0.068)	-0.181** (0.071)	-0.119* (0.068)	-0.256*** (0.068)	-0.231*** (0.069)	-0.132* (0.071)
Extraversion	-0.102* (0.060)	0.010 (0.062)	0.059 (0.067)	-0.037 (0.067)	-0.058 (0.065)	-0.032 (0.066)	-0.087 (0.071)	-0.075 (0.069)
Neuroticism	0.677*** (0.061)	0.617*** (0.063)	0.657*** (0.067)	0.715*** (0.068)	0.649*** (0.067)	0.687*** (0.066)	0.665*** (0.070)	0.708*** (0.070)
Openness	0.106* (0.063)	0.181*** (0.062)	0.267*** (0.067)	0.380*** (0.070)	0.240*** (0.066)	0.305*** (0.067)	0.331*** (0.067)	0.290*** (0.070)
Cognitive ability	0.049 (0.060)	0.073 (0.064)	0.041 (0.066)	0.054 (0.069)	0.064 (0.065)	0.008 (0.066)	0.076 (0.069)	0.038 (0.070)
<i>N</i>	3,185	3,040	3,040	3,040	3,040	3,040	3,040	3,040

*Notes* Personality and cognitive skills variables are standardized. All models control for job status, household income, any long term condition, month of the interview, age, region, marital status, household size and presence of children. Robust standard errors are in parentheses. \*\*\*, \*\*, and \* denote statistical significance at 0.01, 0.05, and 0.1 levels respectively.

**Table S8. Results for personality and mental health deterioration during the Covid-19 period, excluding control variables**

	Dep. var. = GHQ12 (0 to 12)						
	(1) 2019 and Apr 2020	(2) 2019 and May 2020	(3) 2019 and Jun 2020	(4) 2019 and Jul 2020	(5) 2019 and Sep 2020	(6) 2019 and Nov 2020	(7) 2019 and Jan 2021
During Covid-19 period	0.501*** (0.089)	0.513*** (0.115)	0.463*** (0.097)	0.207* (0.116)	0.047 (0.114)	0.469*** (0.115)	0.541*** (0.118)
Female × during	0.843*** (0.139)	0.527*** (0.155)	0.412*** (0.139)	0.131 (0.157)	0.495*** (0.153)	0.428*** (0.160)	0.597*** (0.157)
Agreeableness × during	-0.107 (0.080)	-0.210*** (0.073)	-0.105 (0.074)	-0.055 (0.082)	-0.170** (0.075)	-0.121* (0.073)	-0.155** (0.074)
Conscientious × during	-0.144* (0.084)	-0.097 (0.079)	-0.112 (0.078)	-0.138* (0.081)	-0.078 (0.073)	-0.090 (0.075)	-0.005 (0.074)
Extraversion × during	0.129* (0.077)	0.144* (0.075)	0.088 (0.070)	0.028 (0.070)	0.099 (0.066)	-0.019 (0.075)	-0.058 (0.072)
Neuroticism × during	-0.041 (0.067)	-0.028 (0.067)	0.050 (0.064)	-0.047 (0.066)	-0.063 (0.068)	-0.056 (0.071)	-0.017 (0.070)
Openness × during	0.038 (0.071)	0.130* (0.075)	0.156** (0.073)	0.070 (0.075)	0.152** (0.075)	0.196*** (0.075)	0.213*** (0.077)
Cognitive Skills × during	0.107 (0.066)	0.082 (0.092)	0.096 (0.076)	0.054 (0.089)	0.014 (0.076)	0.095 (0.085)	0.031 (0.086)
<i>N</i>	11,166	11,166	11,166	11,166	11,166	11,166	11,166

*Notes* Personality and cognitive skills variables are standardized. All models control for individual fixed effects. Clustered standard errors at the individual level are in parentheses. \*\*\*, \*\*, and \* denote statistical significance at 0.01, 0.05, and 0.1 levels respectively.



**Fig. S1. Coefficient plots of the effects of Covid-19 on mental health by personality traits, based on main specification excluding control variables** This figure plots the main coefficients of interest, estimated using Equation 1 excluding control variables, for each pair of a period during Covid-19 and the pre-Covid-19 baseline period. The dependent variable is GHQ-12 caseness (range 0–12). Each dot represents the coefficient for an interaction terms between "During Covid-19 period" and a personality trait variable, and the spike plots the 90% confidence interval.

**Table S9. Personality and mental health deterioration during the Covid-19 period**

	Dep. var. = GHQ12 (0 to 12)						
	(1) 2019 and Apr 2020	(2) 2019 and May 2020	(3) 2019 and Jun 2020	(4) 2019 and Jul 2020	(5) 2019 and Sep 2020	(6) 2019 and Nov 2020	(7) 2019 and Jan 2021
During Covid-19 period	1.159*** (0.348)	1.022*** (0.358)	0.555 (0.344)	0.164 (0.359)	-0.253 (0.328)	0.308 (0.369)	0.458 (0.365)
Female × during	0.803*** (0.139)	0.513*** (0.154)	0.379*** (0.137)	0.123 (0.154)	0.501*** (0.154)	0.437*** (0.161)	0.592*** (0.155)
Agreeableness × during	-0.092 (0.079)	-0.192*** (0.070)	-0.101 (0.073)	-0.056 (0.078)	-0.176** (0.073)	-0.124* (0.073)	-0.149** (0.074)
Conscientious × during	-0.120 (0.081)	-0.083 (0.076)	-0.095 (0.076)	-0.142* (0.078)	-0.096 (0.071)	-0.112 (0.072)	-0.013 (0.071)
Extraversion × during	0.114 (0.075)	0.133* (0.073)	0.079 (0.069)	0.021 (0.069)	0.108 (0.066)	-0.021 (0.075)	-0.054 (0.072)
Neuroticism × during	-0.052 (0.066)	-0.045 (0.066)	0.054 (0.064)	-0.046 (0.064)	-0.056 (0.065)	-0.066 (0.068)	-0.017 (0.069)
Openness × during	0.049 (0.070)	0.145** (0.073)	0.159** (0.071)	0.087 (0.074)	0.162** (0.074)	0.209*** (0.075)	0.228*** (0.076)
Cognitive Skills × during	0.090 (0.064)	0.057 (0.088)	0.095 (0.076)	0.058 (0.085)	0.020 (0.073)	0.101 (0.082)	0.044 (0.083)
<i>N</i>	11,166	11,166	11,166	11,166	11,166	11,166	11,166

*Notes* Personality and cognitive skills variables are standardized. All models control for individual fixed effects, job status, household income, any long term condition, month of the interview, age, region, marital status, household size and presence of children. Clustered standard errors at the individual level are in parentheses. \*\*\*, \*\*, and \* denote statistical significance at 0.01, 0.05, and 0.1 levels respectively.

**Table S10. Personality and mental health (GHQ-12 scale) deterioration during the Covid-19 period**

	Dep. var. = GHQ36 (0 to 36)						
	(1) 2019 and Apr 2020	(2) 2019 and May 2020	(3) 2019 and Jun 2020	(4) 2019 and Jul 2020	(5) 2019 and Sep 2020	(6) 2019 and Nov 2020	(7) 2019 and Jan 2021
During Covid-19 period	1.561*** (0.598)	1.726*** (0.634)	1.662*** (0.579)	0.951 (0.578)	0.342 (0.547)	1.925*** (0.649)	1.950*** (0.603)
Female × during	1.399*** (0.249)	0.746*** (0.273)	0.671*** (0.232)	0.380 (0.239)	0.726*** (0.241)	0.668*** (0.251)	0.956*** (0.241)
Agreeableness × during	-0.337** (0.148)	-0.319** (0.133)	-0.316** (0.137)	-0.187 (0.135)	-0.265** (0.131)	-0.288** (0.133)	-0.326** (0.138)
Conscientious × during	-0.216 (0.134)	-0.146 (0.124)	-0.118 (0.126)	-0.173 (0.130)	-0.177 (0.128)	-0.172 (0.123)	-0.011 (0.124)
Extraversion × during	0.261* (0.134)	0.281** (0.118)	0.192* (0.110)	0.045 (0.113)	0.124 (0.113)	0.086 (0.132)	0.034 (0.128)
Neuroticism × during	-0.088 (0.122)	-0.053 (0.114)	0.056 (0.119)	-0.085 (0.108)	-0.102 (0.118)	-0.038 (0.116)	-0.056 (0.121)
Openness × during	0.022 (0.127)	0.204 (0.126)	0.236** (0.115)	0.117 (0.113)	0.241* (0.123)	0.296** (0.123)	0.279** (0.141)
Cognitive Skills × during	-0.041 (0.125)	-0.010 (0.156)	-0.046 (0.117)	0.128 (0.131)	0.036 (0.111)	0.007 (0.128)	0.028 (0.127)
<i>N</i>	11,166	11,166	11,166	11,166	11,166	11,166	11,166

*Notes* Personality and cognitive skills variables are standardized. All models control for individual fixed effects, job status, household income, any long term condition, month of the interview, age, region, marital status, household size and presence of children. Clustered standard errors at the individual level are in parentheses. \*\*\*, \*\*, and \* denote statistical significance at 0.01, 0.05, and 0.1 levels respectively.

**Table S11. Mental health deterioration during the Covid-19 period among the top and bottom 25% in Neuroticism**

	Dep. var. = GHQ12 (0 to 12)					
	(1) 2019 and Jun 2020	(2) 2019 and Jun 2020	(3) 2019 and Jun 2020	(4) 2019 and Jan 2021	(5) 2019 and Jan 2021	(6) 2019 and Jan 2021
During Covid-19 period		0.557*** (0.090)	0.364*** (0.121)		0.755*** (0.102)	0.455*** (0.134)
Female × during			0.493*** (0.179)			0.765*** (0.197)
Top 25% Neuroticism × during	0.829*** (0.152)	0.272 (0.178)	0.158 (0.173)	1.011*** (0.173)	0.257 (0.200)	0.080 (0.193)
Cognitive Skills × during	0.084 (0.078)	0.085 (0.077)	0.110 (0.079)	0.059 (0.089)	0.061 (0.087)	0.100 (0.086)
<i>N</i>	8,365	8,365	8,365	8,365	8,365	8,365

*Notes* Only respondents scoring top and bottom 25% in Neuroticism are included. All models control for individual fixed effects, job status, household income, any long term condition, month of the interview, age, region, marital status, household size and presence of children. Clustered standard errors at the individual level are in parentheses. \*\*\*, \*\*, and \* denote statistical significance at 0.01, 0.05, and 0.1 levels respectively.

**Table S12. Interactional effects between Big-5 personality traits**

	Dep. var. = GHQ12 (0 to 12)						
	(1) 2019 and Apr 2020	(2) 2019 and May 2020	(3) 2019 and Jun 2020	(4) 2019 and Jul 2020	(5) 2019 and Sep 2020	(6) 2019 and Nov 2020	(7) 2019 and Jan 2021
During Covid-19 period	1.173*** (0.347)	1.010*** (0.359)	0.543 (0.345)	0.159 (0.361)	-0.248 (0.328)	0.303 (0.370)	0.451 (0.364)
Female × during	0.801*** (0.137)	0.511*** (0.154)	0.373*** (0.137)	0.129 (0.154)	0.496*** (0.153)	0.428*** (0.162)	0.586*** (0.155)
Agreeableness × during	-0.092 (0.074)	-0.188*** (0.067)	-0.089 (0.068)	-0.062 (0.074)	-0.170** (0.070)	-0.111 (0.070)	-0.141* (0.073)
Conscientious × during	-0.121 (0.079)	-0.089 (0.076)	-0.089 (0.074)	-0.136* (0.076)	-0.093 (0.068)	-0.112 (0.069)	-0.019 (0.070)
Extraversion × during	0.113 (0.074)	0.140* (0.073)	0.082 (0.068)	0.016 (0.067)	0.109* (0.065)	-0.019 (0.074)	-0.041 (0.072)
Neuroticism × during	-0.050 (0.065)	-0.046 (0.066)	0.057 (0.064)	-0.047 (0.064)	-0.053 (0.065)	-0.063 (0.068)	-0.016 (0.068)
Openness × during	0.050 (0.066)	0.138** (0.070)	0.145** (0.067)	0.093 (0.071)	0.153** (0.070)	0.201*** (0.072)	0.211*** (0.074)
Cognitive Skills × during	0.089 (0.063)	0.057 (0.088)	0.097 (0.076)	0.058 (0.085)	0.020 (0.073)	0.102 (0.082)	0.044 (0.082)
Neuroticism × Agreeableness × during	-0.002 (0.074)	-0.021 (0.064)	-0.052 (0.066)	0.032 (0.069)	-0.017 (0.070)	-0.070 (0.064)	-0.027 (0.065)
Neuroticism × Conscientious × during	0.026 (0.077)	0.032 (0.080)	-0.033 (0.068)	-0.052 (0.069)	0.008 (0.072)	0.009 (0.071)	0.047 (0.073)
Neuroticism × Extraversion × during	0.030 (0.081)	-0.046 (0.070)	-0.010 (0.063)	0.007 (0.065)	0.031 (0.058)	-0.005 (0.063)	-0.049 (0.059)
Neuroticism × Openness × during	0.007 (0.062)	0.027 (0.063)	0.054 (0.066)	-0.030 (0.059)	0.058 (0.075)	0.018 (0.066)	0.094 (0.064)
<i>N</i>	11,166	11,166	11,166	11,166	11,166	11,166	11,166

*Notes* Personality and cognitive skills variables are standardized. All models control for individual fixed effects, job status, household income, any long term condition, month of the interview, age, region, marital status, household size and presence of children. Clustered standard errors at the individual level are in parentheses. \*\*\*, \*\*, and \* denote statistical significance at 0.01, 0.05, and 0.1 levels respectively.

**Table S13. Placebo test using Wave 8 Main Survey as baseline and Wave 9 Main Survey as intervention year**

Dep. var. = GHQ12 (0 to 12), baseline = Wave 8 main survey, intervention = Wave 9 main survey	
Wave 9	0.093 (0.144)
Female × during Wave 9	-0.091 (0.132)
Agreeableness × during	-0.053 (0.064)
Conscientious × during	0.057 (0.067)
Extraversion × during	0.035 (0.062)
Neuroticism × during	0.021 (0.066)
Openness × during	0.003 (0.060)
Cognitive Skills × during	0.009 (0.061)
<i>N</i>	11,301

*Notes* Personality and cognitive skills variables are standardized. All models control for individual fixed effects, job status, household income, any long term condition, month of the interview, age, region, marital status, household size and presence of children. Clustered standard errors at the individual level are in parentheses. \*\*\*, \*\*, and \* denote statistical significance at 0.01, 0.05, and 0.1 levels respectively.

**Table S14. Robustness check on other psychological factors**

	Dep. var. = GHQ12 (0 to 12)						
	(1) 2019 and Apr 2020	(2) 2019 and May 2020	(3) 2019 and Jun 2020	(4) 2019 and Jul 2020	(5) 2019 and Sep 2020	(6) 2019 and Nov 2020	(7) 2019 and Jan 2021
During Covid-19 period	0.536 (0.625)	1.375* (0.706)	0.818 (0.594)	0.693 (0.723)	0.166 (0.720)	0.793 (0.760)	1.380* (0.750)
Female × during	0.714*** (0.171)	0.224 (0.207)	0.258 (0.173)	0.002 (0.209)	0.507** (0.201)	0.456** (0.214)	0.466** (0.209)
Agreeableness × during	-0.031 (0.101)	-0.128 (0.087)	-0.053 (0.094)	-0.055 (0.105)	-0.204** (0.086)	-0.112 (0.088)	-0.098 (0.094)
Conscientious × during	-0.118 (0.109)	-0.103 (0.096)	-0.091 (0.096)	-0.136 (0.098)	-0.146* (0.080)	-0.205*** (0.077)	-0.064 (0.089)
Extraversion × during	0.085 (0.093)	0.143 (0.093)	0.145 (0.090)	0.034 (0.089)	0.146* (0.075)	-0.017 (0.088)	-0.060 (0.089)
Neuroticism × during	0.013 (0.087)	0.000 (0.082)	0.048 (0.081)	-0.025 (0.084)	-0.045 (0.076)	-0.091 (0.082)	-0.061 (0.085)
Openness × during	0.064 (0.089)	0.215** (0.095)	0.172* (0.089)	0.201* (0.105)	0.209** (0.098)	0.271*** (0.099)	0.309*** (0.102)
Cognitive Skills × during	0.065 (0.084)	0.005 (0.129)	0.129 (0.110)	0.009 (0.121)	-0.063 (0.097)	0.116 (0.113)	0.088 (0.115)
Optimism × during	0.017 (0.100)	0.016 (0.093)	0.007 (0.100)	-0.005 (0.100)	-0.003 (0.095)	-0.026 (0.102)	-0.095 (0.101)
Risk attitude × during	-0.026 (0.036)	-0.033 (0.038)	-0.025 (0.038)	-0.048 (0.036)	-0.054 (0.035)	-0.028 (0.033)	-0.045 (0.036)
Locus of control × during	0.140** (0.065)	0.035 (0.069)	0.038 (0.068)	0.023 (0.075)	-0.016 (0.059)	-0.015 (0.064)	-0.020 (0.063)
<i>N</i>	6,754	6,754	6,754	6,754	6,754	6,754	6,754

*Notes* Personality and cognitive skills variables are standardized. All models control for individual fixed effects, job status, household income, any long term condition, month of the interview, age, region, marital status, household size and presence of children. Clustered standard errors at the individual level are in parentheses. \*\*\*, \*\*, and \* denote statistical significance at 0.01, 0.05, and 0.1 levels respectively.

**Table S15. Personality and mental health deterioration during the Covid-19 period, without sampling weights**

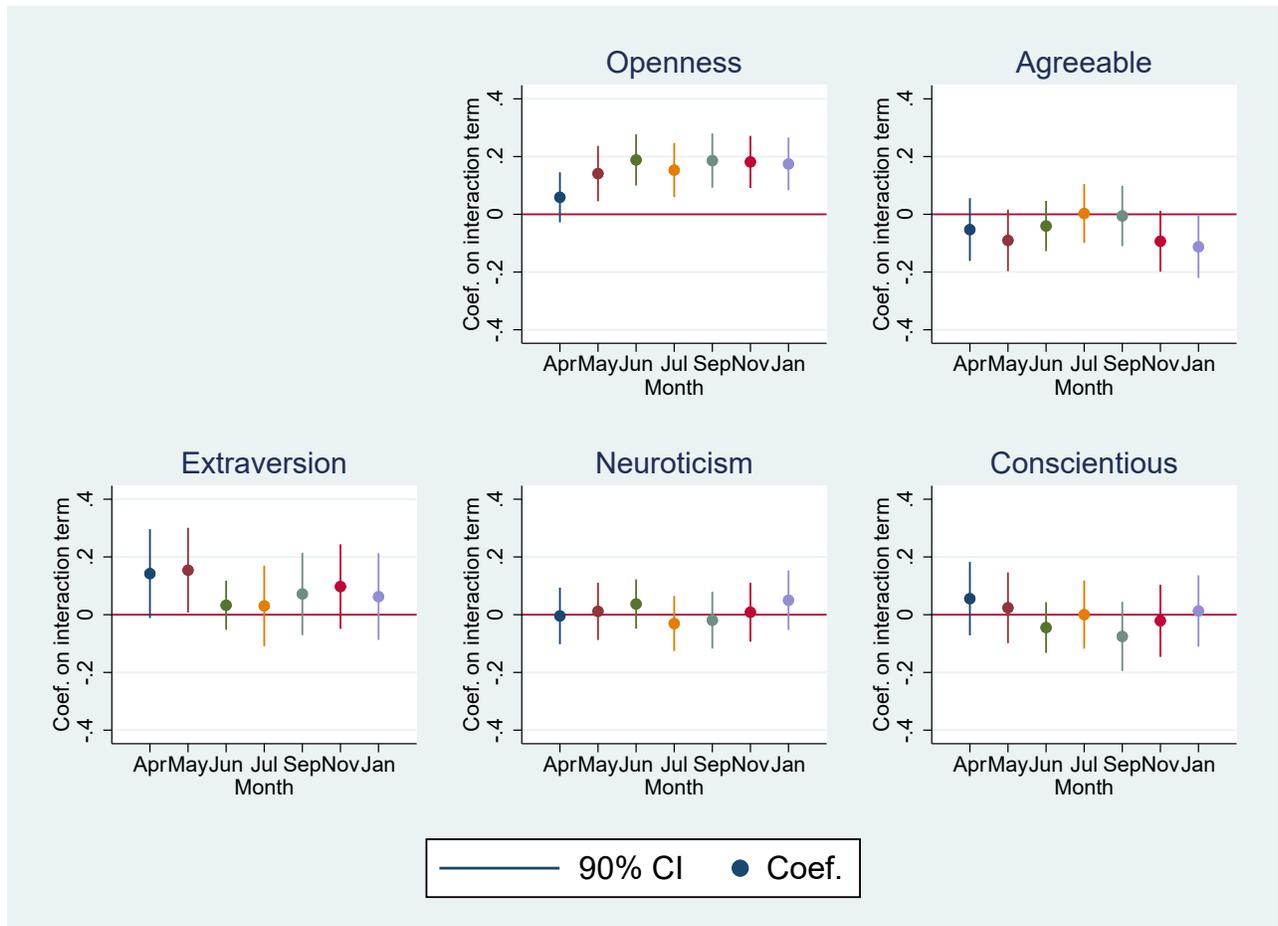
	Dep. var. = GHQ12 (0 to 12)						
	(1) 2019 and Apr 2020	(2) 2019 and May 2020	(3) 2019 and Jun 2020	(4) 2019 and Jul 2020	(5) 2019 and Sep 2020	(6) 2019 and Nov 2020	(7) 2019 and Jan 2021
During Covid-19 period	0.952*** (0.215)	0.432** (0.214)	0.194 (0.215)	-0.246 (0.211)	-0.370* (0.217)	-0.078 (0.226)	0.205 (0.231)
Female × during	0.685*** (0.088)	0.515*** (0.088)	0.397*** (0.091)	0.215** (0.087)	0.393*** (0.088)	0.468*** (0.092)	0.511*** (0.092)
Agreeableness × during	-0.028 (0.048)	-0.083* (0.048)	-0.075 (0.049)	-0.014 (0.046)	-0.008 (0.047)	-0.079 (0.049)	-0.102** (0.049)
Conscientious × during	0.004 (0.048)	-0.009 (0.048)	-0.034 (0.049)	-0.023 (0.047)	-0.093* (0.048)	-0.079 (0.048)	-0.024 (0.049)
Extraversion × during	0.045 (0.047)	0.085* (0.047)	0.041 (0.047)	-0.008 (0.045)	0.034 (0.045)	0.019 (0.048)	0.007 (0.047)
Neuroticism × during	-0.006 (0.047)	0.006 (0.048)	0.076 (0.049)	-0.029 (0.046)	-0.014 (0.048)	0.000 (0.049)	0.056 (0.050)
Openness × during	0.037 (0.046)	0.095** (0.047)	0.157*** (0.049)	0.106** (0.047)	0.132*** (0.047)	0.150*** (0.049)	0.147*** (0.049)
Cognitive Skills × during	0.096** (0.043)	0.109** (0.043)	0.115*** (0.044)	0.117*** (0.041)	0.095** (0.042)	0.117*** (0.045)	0.073* (0.044)
<i>N</i>	12,292	12,292	12,292	12,292	12,292	12,292	12,292

*Notes* Personality and cognitive skills variables are standardized. All models control for individual fixed effects, job status, household income, any long term condition, month of the interview, age, region, marital status, household size and presence of children. Clustered standard errors at the individual level are in parentheses. \*\*\*, \*\*, and \* denote statistical significance at 0.01, 0.05, and 0.1 levels respectively.

**Table S16. Results with inverse probability weighting**

	Dep. var. = GHQ12 (0 to 12)						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	2019 and Apr 2020	2019 and May 2020	2019 and Jun 2020	2019 and Jul 2020	2019 and Sep 2020	2019 and Nov 2020	2019 and Jan 2021
During Covid-19 period	0.855** (0.397)	0.331 (0.378)	0.233 (0.234)	-0.652* (0.378)	-0.460 (0.354)	-0.171 (0.307)	0.067 (0.410)
Female × during	0.634*** (0.122)	0.467*** (0.119)	0.420*** (0.096)	0.157 (0.115)	0.330*** (0.118)	0.460*** (0.127)	0.492*** (0.125)
Agreeableness × during	-0.053 (0.066)	-0.090 (0.065)	-0.041 (0.053)	0.003 (0.062)	-0.006 (0.064)	-0.093 (0.064)	-0.112* (0.066)
Conscientious × during	0.056 (0.077)	0.024 (0.074)	-0.045 (0.053)	0.000 (0.072)	-0.075 (0.073)	-0.021 (0.076)	0.013 (0.075)
Extraversion × during	0.142 (0.094)	0.154* (0.089)	0.033 (0.052)	0.030 (0.085)	0.072 (0.087)	0.097 (0.089)	0.063 (0.091)
Neuroticism × during	-0.004 (0.060)	0.012 (0.060)	0.037 (0.052)	-0.031 (0.058)	-0.019 (0.060)	0.009 (0.062)	0.050 (0.063)
Openness × during	0.059 (0.053)	0.141** (0.058)	0.188*** (0.054)	0.153*** (0.057)	0.186*** (0.057)	0.181*** (0.055)	0.175*** (0.055)
Cognitive Skills × during	0.085* (0.046)	0.080* (0.048)	0.106** (0.046)	0.116*** (0.045)	0.108** (0.046)	0.102** (0.048)	0.073 (0.047)
<i>N</i>	12,292	12,292	12,292	12,292	12,292	12,292	12,292

*Notes* Non-attrition probability are estimated based on demographic and socio-economics characteristics including sex, age, age squared, ethnicity, educational qualifications, and job status at baseline, based on the full panel of UKHLS Covid Studies. Personality and cognitive skills variables are standardized. All models control for individual fixed effects, job status, household income, any long term condition, month of the interview, age, region, marital status, household size and presence of children. Clustered standard errors at the individual level are in parentheses. \*\*\*, \*\*, and \* denote statistical significance at 0.01, 0.05, and 0.1 levels respectively.



**Fig. S2. Coefficient plots of the effects of Covid-19 on mental health by personality traits, based on main specification with inverse probability weighting** This figure plots the main coefficients of interest, estimated using Equation 1 with inverse probability weighting, for each pair of a period during Covid-19 and the pre-Covid-19 baseline period. The dependent variable is GHQ-12 caseness. Each dot represents the coefficient for an interaction term between "During Covid-19 period" and a personality trait variable, and the spike plots the 90% confidence interval.

**Table S17. Personality and mental health deterioration during the Covid-19 period, excluding over 60s and under 27s**

	Dep. var. = GHQ12 (0 to 12)						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	2019 and Apr 2020	2019 and May 2020	2019 and Jun 2020	2019 and Jul 2020	2019 and Sep 2020	2019 and Nov 2020	2019 and Jan 2021
During Covid-19 period	1.142** (0.562)	1.036* (0.598)	0.799 (0.612)	-0.215 (0.609)	-0.704 (0.526)	0.907 (0.627)	1.397** (0.671)
Female × during	1.118*** (0.192)	0.627*** (0.226)	0.458** (0.201)	0.105 (0.228)	0.620*** (0.233)	0.540** (0.236)	0.674*** (0.239)
Agreeableness × during	-0.082 (0.109)	-0.223** (0.097)	-0.093 (0.104)	-0.032 (0.112)	-0.182* (0.104)	-0.122 (0.103)	-0.180 (0.110)
Conscientious × during	-0.028 (0.116)	-0.012 (0.101)	-0.039 (0.111)	-0.104 (0.117)	-0.036 (0.104)	-0.072 (0.107)	0.036 (0.104)
Extraversion × during	0.098 (0.105)	0.170 (0.104)	0.117 (0.104)	0.065 (0.104)	0.114 (0.099)	-0.092 (0.111)	-0.071 (0.109)
Neuroticism × during	-0.130 (0.096)	-0.122 (0.094)	-0.005 (0.096)	-0.053 (0.099)	-0.056 (0.100)	-0.105 (0.101)	-0.065 (0.104)
Openness × during	0.133 (0.103)	0.225** (0.108)	0.274*** (0.106)	0.153 (0.114)	0.288** (0.112)	0.378*** (0.112)	0.377*** (0.114)
Cognitive Skills × during	-0.006 (0.087)	-0.076 (0.135)	-0.016 (0.119)	-0.069 (0.130)	-0.145 (0.110)	-0.011 (0.119)	-0.014 (0.128)
<i>N</i>	8,263	8,263	8,263	8,263	8,263	8,263	8,263

*Notes* Personality and cognitive skills variables are standardized. All models control for individual fixed effects, job status, household income, any long term condition, month of the interview, age, region, marital status, household size and presence of children. Clustered standard errors at the individual level are in parentheses. \*\*\*, \*\*, and \* denote statistical significance at 0.01, 0.05, and 0.1 levels respectively.

**Table S18. Specification checks: personality and mental health deterioration between baseline and June 2020**

	Dep. var. = GHQ12 (0 to 12)		
	(1) 2019 and Jun 2020	(2) 2019 and Jun 2020	(3) 2019 and Jun 2020
During Covid-19 period	0.511*** (0.116)	0.513*** (0.115)	1.022*** (0.358)
Female × during	0.514*** (0.151)	0.527*** (0.155)	0.513*** (0.154)
Agreeableness × during	-0.216*** (0.072)	-0.210*** (0.073)	-0.192*** (0.070)
Conscientious × during	-0.099 (0.079)	-0.097 (0.079)	-0.083 (0.076)
Extraversion × during	0.140* (0.076)	0.144* (0.075)	0.133* (0.073)
Neuroticism × during	-0.032 (0.067)	-0.028 (0.067)	-0.045 (0.066)
Openness × during	0.148* (0.076)	0.130* (0.075)	0.145** (0.073)
Cognitive Skills × during		0.082 (0.092)	0.057 (0.088)
Controls	No	No	Yes
N	11,166	11,166	11,166

*Notes* Personality and cognitive skills variables are standardized. Column (3) controls for individual fixed effects, job status, household income, any long term condition, month of the interview, age, region, marital status, household size and presence of children. Clustered standard errors at the individual level are in parentheses. \*\*\*, \*\*, and \* denote statistical significance at 0.01, 0.05, and 0.1 levels respectively.

**Table S19. Specification checks: personality and mental health deterioration between baseline and January 2021**

	Dep. var. = GHQ12 (0 to 12)		
	(1) 2019 and Jan 2021	(2) 2019 and Jan 2021	(3) 2019 and Jan 2021
During Covid-19 period	0.540*** (0.119)	0.541*** (0.118)	0.458 (0.365)
Female × during	0.592*** (0.155)	0.597*** (0.157)	0.592*** (0.155)
Agreeableness × during	-0.157** (0.073)	-0.155** (0.074)	-0.149** (0.074)
Conscientious × during	-0.005 (0.074)	-0.005 (0.074)	-0.013 (0.071)
Extraversion × during	-0.059 (0.073)	-0.058 (0.072)	-0.054 (0.072)
Neuroticism × during	-0.018 (0.070)	-0.017 (0.070)	-0.017 (0.069)
Openness × during	0.220*** (0.073)	0.213*** (0.077)	0.228*** (0.076)
Cognitive Skills × during		0.031 (0.086)	0.044 (0.083)
Controls	No	No	Yes
N	11,166	11,166	11,166

*Notes* Personality and cognitive skills variables are standardized. Column (3) controls for individual fixed effects, job status, household income, any long term condition, month of the interview, age, region, marital status, household size and presence of children. Clustered standard errors at the individual level are in parentheses. \*\*\*, \*\*, and \* denote statistical significance at 0.01, 0.05, and 0.1 levels respectively.

**Table S20. Personality and mental health deterioration during the Covid-19 Period, females only**

	Dep. var. = GHQ12 (0 to 12)						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	2019 and Apr 2020	2019 and May 2020	2019 and Jun 2020	2019 and Jul 2020	2019 and Sep 2020	2019 and Nov 2020	2019 and Jan 2021
During Covid-19 period	2.606*** (0.482)	1.656*** (0.391)	0.861** (0.419)	-0.121 (0.444)	0.189 (0.445)	0.470 (0.493)	1.198** (0.505)
Agreeableness × during	-0.131 (0.128)	-0.182* (0.103)	-0.224** (0.113)	-0.101 (0.126)	-0.250** (0.112)	-0.146 (0.113)	-0.134 (0.101)
Conscientious × during	-0.161 (0.125)	-0.056 (0.099)	-0.113 (0.107)	-0.152 (0.119)	-0.056 (0.101)	-0.094 (0.107)	-0.008 (0.096)
Extraversion × during	0.138 (0.109)	0.187* (0.100)	0.064 (0.100)	0.102 (0.099)	0.147 (0.092)	-0.023 (0.108)	-0.152 (0.103)
Neuroticism × during	-0.041 (0.094)	-0.019 (0.089)	0.039 (0.088)	-0.030 (0.087)	-0.014 (0.095)	-0.018 (0.095)	0.013 (0.093)
Openness × during	0.116 (0.099)	0.132 (0.094)	0.252*** (0.098)	0.050 (0.096)	0.182* (0.094)	0.250*** (0.089)	0.284*** (0.091)
Cognitive Skills × during	0.134 (0.086)	0.198** (0.084)	0.159* (0.093)	0.233*** (0.084)	0.111 (0.078)	0.220*** (0.084)	0.136 (0.085)
<i>N</i>	8,806	8,806	8,806	8,806	8,806	8,806	8,806

*Notes* Personality and cognitive skills variables are standardized. All models control for individual fixed effects, job status, household income, any long term condition, month of the interview, age, region, marital status, household size and presence of children. Clustered standard errors at the individual level are in parentheses. \*\*\*, \*\*, and \* denote statistical significance at 0.01, 0.05, and 0.1 levels respectively.

**Table S21. Personality and mental health deterioration during the Covid-19 period, males only**

	Dep. var. = GHQ12 (0 to 12)						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	2019 and Apr 2020	2019 and May 2020	2019 and Jun 2020	2019 and Jul 2020	2019 and Sep 2020	2019 and Nov 2020	2019 and Jan 2021
During Covid-19 period	0.507 (0.421)	0.863 (0.530)	0.728 (0.495)	0.672 (0.480)	-0.281 (0.393)	0.517 (0.449)	0.259 (0.471)
Agreeableness × during	-0.029 (0.086)	-0.199** (0.090)	0.033 (0.089)	-0.028 (0.092)	-0.088 (0.095)	-0.082 (0.092)	-0.149 (0.107)
Conscientious × during	-0.088 (0.093)	-0.135 (0.116)	-0.074 (0.108)	-0.118 (0.096)	-0.172* (0.096)	-0.163* (0.090)	-0.051 (0.105)
Extraversion × during	0.095 (0.097)	0.082 (0.100)	0.103 (0.092)	-0.056 (0.086)	0.083 (0.094)	-0.024 (0.098)	0.063 (0.097)
Neuroticism × during	-0.077 (0.088)	-0.080 (0.101)	0.085 (0.093)	-0.040 (0.093)	-0.082 (0.092)	-0.084 (0.094)	-0.022 (0.102)
Openness × during	-0.049 (0.094)	0.158 (0.115)	0.033 (0.103)	0.129 (0.111)	0.138 (0.114)	0.167 (0.121)	0.162 (0.126)
Cognitive Skills × during	0.020 (0.094)	-0.130 (0.158)	0.012 (0.120)	-0.171 (0.152)	-0.101 (0.132)	-0.039 (0.143)	-0.074 (0.135)
<i>N</i>	7,943	7,943	7,943	7,943	7,943	7,943	7,943

*Notes* Personality and cognitive skills variables are standardized. All models control for individual fixed effects, job status, household income, any long term condition, month of the interview, age, region, marital status, household size and presence of children. Clustered standard errors at the individual level are in parentheses. \*\*\*, \*\*, and \* denote statistical significance at 0.01, 0.05, and 0.1 levels respectively.

**Table S22. Heterogeneity by ethnicity**

	Dep. var. = GHQ12 (0 to 12)						
	(1) 2019 and Apr 2020	(2) 2019 and May 2020	(3) 2019 and Jun 2020	(4) 2019 and Jul 2020	(5) 2019 and Sep 2020	(6) 2019 and Nov 2020	(7) 2019 and Jan 2021
During Covid-19 period	1.173*** (0.352)	0.996*** (0.367)	0.545 (0.351)	0.177 (0.367)	-0.232 (0.336)	0.318 (0.371)	0.459 (0.373)
Female × during	0.811*** (0.138)	0.529*** (0.155)	0.377*** (0.139)	0.132 (0.155)	0.521*** (0.154)	0.436*** (0.161)	0.600*** (0.156)
BAME × during	-0.251 (0.258)	0.013 (0.249)	-0.183 (0.222)	-0.180 (0.238)	-0.237 (0.234)	-0.071 (0.254)	0.076 (0.245)
Agreeableness × during	-0.096 (0.079)	-0.211*** (0.074)	-0.110 (0.077)	-0.066 (0.082)	-0.188** (0.076)	-0.141* (0.077)	-0.150* (0.079)
Conscientious × during	-0.150* (0.084)	-0.090 (0.080)	-0.117 (0.080)	-0.165** (0.082)	-0.100 (0.074)	-0.140* (0.075)	-0.024 (0.074)
Extraversion × during	0.064 (0.077)	0.105 (0.076)	0.065 (0.073)	-0.009 (0.071)	0.067 (0.069)	-0.029 (0.079)	-0.079 (0.077)
Neuroticism × during	-0.052 (0.070)	-0.062 (0.070)	0.054 (0.068)	-0.057 (0.068)	-0.073 (0.070)	-0.079 (0.073)	-0.047 (0.073)
Openness × during	0.011 (0.072)	0.109 (0.077)	0.106 (0.074)	0.061 (0.078)	0.142* (0.079)	0.182** (0.078)	0.210*** (0.080)
Cognitive Skills × during	0.110 (0.070)	0.059 (0.099)	0.106 (0.086)	0.068 (0.096)	0.020 (0.083)	0.094 (0.091)	0.028 (0.094)
BAME × Agreeableness × during	0.005 (0.308)	0.196 (0.264)	0.148 (0.250)	0.098 (0.260)	0.059 (0.253)	0.214 (0.242)	-0.039 (0.248)
BAME × Conscientious × during	0.387 (0.301)	0.078 (0.268)	0.249 (0.269)	0.299 (0.266)	0.034 (0.261)	0.385 (0.280)	0.162 (0.264)
BAME × Extraversion × during	0.701** (0.305)	0.313 (0.290)	0.176 (0.256)	0.374 (0.270)	0.483* (0.275)	0.048 (0.286)	0.274 (0.256)
BAME × Neuroticism × during	0.037 (0.221)	0.201 (0.209)	0.079 (0.216)	0.146 (0.216)	0.188 (0.204)	0.192 (0.207)	0.348* (0.205)
BAME × Openness × during	0.529* (0.273)	0.499* (0.278)	0.736*** (0.252)	0.400 (0.273)	0.370 (0.269)	0.391 (0.289)	0.243 (0.283)
BAME × Cognitive Skills × during	-0.341* (0.193)	-0.079 (0.185)	-0.202 (0.166)	-0.198 (0.170)	-0.116 (0.163)	-0.010 (0.203)	0.135 (0.164)
<i>N</i>	11,166	11,166	11,166	11,166	11,166	11,166	11,166

*Notes* Personality and cognitive skills variables are standardized. All models control for individual fixed effects, job status, household income, any long term condition, month of the interview, age, region, marital status, household size and presence of children. Clustered standard errors at the individual level are in parentheses. \*\*\*, \*\*, and \* denote statistical significance at 0.01, 0.05, and 0.1 levels respectively.

**Table S23. Heterogeneity by age group**

	Dep. var. = GHQ12 (0 to 12)						
	(1) 2019 and Apr 2020	(2) 2019 and May 2020	(3) 2019 and Jun 2020	(4) 2019 and Jul 2020	(5) 2019 and Sep 2020	(6) 2019 and Nov 2020	(7) 2019 and Jan 2021
During Covid-19 period	1.439*** (0.441)	1.251*** (0.437)	0.734* (0.435)	0.182 (0.440)	-0.179 (0.405)	0.818* (0.482)	0.980** (0.477)
Female × during	0.787*** (0.137)	0.493*** (0.152)	0.371*** (0.135)	0.121 (0.152)	0.490*** (0.152)	0.437*** (0.160)	0.580*** (0.155)
Age over 65 × during	0.256 (0.201)	0.232 (0.220)	0.195 (0.196)	0.044 (0.211)	0.102 (0.208)	0.558** (0.238)	0.525** (0.227)
Agreeableness × during	-0.065 (0.097)	-0.211** (0.089)	-0.097 (0.091)	-0.032 (0.099)	-0.185** (0.092)	-0.095 (0.091)	-0.170* (0.095)
Conscientious × during	0.040 (0.102)	0.067 (0.091)	0.023 (0.097)	-0.072 (0.102)	0.007 (0.092)	-0.023 (0.093)	0.062 (0.091)
Extraversion × during	0.124 (0.094)	0.117 (0.093)	0.043 (0.090)	0.021 (0.091)	0.103 (0.087)	-0.041 (0.098)	-0.057 (0.095)
Neuroticism × during	-0.033 (0.085)	-0.038 (0.084)	0.031 (0.083)	-0.070 (0.085)	-0.053 (0.086)	-0.067 (0.089)	-0.025 (0.090)
Openness × during	0.085 (0.091)	0.205** (0.098)	0.229** (0.093)	0.118 (0.100)	0.229** (0.099)	0.295*** (0.098)	0.333*** (0.100)
Cognitive Skills × during	0.031 (0.077)	-0.026 (0.118)	0.022 (0.099)	0.006 (0.111)	-0.065 (0.095)	0.041 (0.106)	0.035 (0.110)
Age over 65 × Agreeableness × during	-0.046 (0.149)	0.126 (0.124)	0.017 (0.128)	-0.076 (0.143)	0.069 (0.136)	-0.075 (0.143)	0.131 (0.130)
Age over 65 × Conscientious × during	-0.491*** (0.166)	-0.467*** (0.161)	-0.354** (0.147)	-0.204 (0.145)	-0.307** (0.134)	-0.219 (0.140)	-0.227 (0.141)
Age over 65 × Extraversion × during	-0.043 (0.148)	0.037 (0.134)	0.123 (0.130)	-0.001 (0.126)	0.006 (0.121)	0.069 (0.140)	0.027 (0.126)
Age over 65 × Neuroticism × during	-0.036 (0.121)	-0.003 (0.121)	0.090 (0.119)	0.083 (0.110)	-0.003 (0.113)	0.043 (0.121)	0.078 (0.122)
Age over 65 × Openness × during	-0.109 (0.126)	-0.207* (0.126)	-0.241* (0.124)	-0.095 (0.123)	-0.225* (0.124)	-0.309** (0.131)	-0.379*** (0.131)
Age over 65 × Cognitive Skills × during	0.146 (0.128)	0.234 (0.143)	0.202 (0.126)	0.150 (0.142)	0.261** (0.127)	0.193 (0.141)	0.010 (0.138)
<i>N</i>	11,166	11,166	11,166	11,166	11,166	11,166	11,166

*Notes* Personality and cognitive skills variables are standardized. All models control for individual fixed effects, job status, household income, any long term condition, month of the interview, age, region, marital status, household size and presence of children. Clustered standard errors at the individual level are in parentheses. \*\*\*, \*\*, and \* denote statistical significance at 0.01, 0.05, and 0.1 levels respectively.

115 **References**

- 116 1. S McFall, Understanding Society: UK Household Longitudinal Study: Cognitive ability measures, (Institute for Social and  
117 Economic Research, University of Essex), Technical report (2013).
- 118 2. S Rosenfield, D Mouzon, Gender and mental health in *Handbook of the sociology of mental health*. (Springer), pp. 277–296  
119 (2013).
- 120 3. R Kotov, W Gamez, F Schmidt, D Watson, Linking “big” personality traits to anxiety, depressive, and substance use  
121 disorders: a meta-analysis. *Psychol. Bull.* **136**, 768 (2010).
- 122 4. DN Klein, R Kotov, SJ Bufferd, Personality and depression: explanatory models and review of the evidence. *Annu. Rev.*  
123 *Clin. Psychol.* **7**, 269 (2011).
- 124 5. D Watson, LA Clark, On traits and temperament: General and specific factors of emotional experience and their relation  
125 to the five-factor model. *J. Pers.* **60**, 441–476 (1992).
- 126 6. E Diener, RE Lucas, Personality and subjective well-being in *Well-Being: The Foundations of Hedonic Psychology*. (Russell  
127 Sage Foundation, New York, NY), pp. 213–229 (1999).
- 128 7. E Proto, A Rustichini, Life satisfaction, income and personality. *J. Econ. Psychol.* **48**, 17–32 (2015).