

Personality Traits and Mental Health Outcomes: The Effect of the Covid-19 Pandemic on Young Adults in the U.K.

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Abstract

Mental health outcomes significantly deteriorated in the United Kingdom as a result of the Covid-19 pandemic, particularly for younger individuals. This paper uses data from the Millennium Cohort Study to investigate the heterogeneity of mental health effects of the Covid-19 pandemic on adolescents by both personality types and personality traits. Using two-step cluster analysis we find three robust personality clusters: resilient, overcontrolled, and undercontrolled. We find that resilient individuals, who generally have better mental health, reported larger decreases in mental health during the pandemic than both undercontrollers and overcontrollers. The effect seems to be driven by the neuroticism trait, such that those with higher neuroticism scores fared better than those with lower scores during the pandemic. Our findings highlight that personality traits are important factors in identifying stress-prone individuals during a pandemic.

Keywords: Mental Health, Personality, Covid-19, Resilience , Neuroticism

1 Introduction

Mental health outcomes in Great Britain have significantly deteriorated in the wake of the Covid-19 pandemic (Gray, 2021). According to the Financial Times, the number of individuals reporting moderate to extreme symptoms of depression has risen from 10 percent of people surveyed in the months before the coronavirus pandemic to 21 percent between January and March 2021. Younger people's mental health suffered disproportionately; with 34 percent of those aged between 16 and 29 reporting symptoms compared to 18 percent among those in their 50s.

It is crucial to address young people's mental health as studies have indicated that most mental disorders begin between the ages of 12 and 24 (Patel et al., 2007). Poor mental health is of concern in and of itself; affecting individuals' thought processes, choices and behaviours (Banks and Xu, 2020), but it has further been identified as a risk factor for declining physical health (Kivimäki et al., 2017). Moreover, poor mental health significantly hinders youth development; leading to lower educational achievement, substance abuse, violence, poor reproductive and sexual health. These consequently have profound consequences for outcomes in adulthood (Patel et al., 2007). Examining the factors that shape the mental health outcomes of individuals is necessary to find a solution that can improve the health of young people and empower them to fulfil their potential in the post-pandemic landscape.

Personality forms an important basis as to how individuals respond to stressful situations (Miller and Harrington, 2011). Personality can be defined as the relatively persistent patterns of thought, feelings, and behaviours characterising tendencies to respond in specific ways under certain circumstances (Roberts, 2009). These traits are stable and reliable indicators of how individuals respond differently to life situations (Almlund et al., 2011). Due to the unexpected and exogenous nature of the coronavirus shock, Judge and Zapata (2015) have argued that individuals' reactions may be particularly strong, and therefore, reflect dispositional characteristics measured

by innate personality traits.

This premise underlies the strand of literature examining the relationship between personality and resilience under stressful situations such as the coronavirus pandemic. Resilience can be defined as an ability that enables individuals to adapt more effectively to stressful circumstances (Fletcher and Sarkar, 2013). Therefore, resilience can constitute the mechanism through which personality traits impact psychological functioning under distress (Kocjan et al., 2021). Miller and Harrington (2011) establish that personality traits are one of the most significant determinants of emotional resilience under stress. This is substantiated by findings from Campbell-Sills et al. (2006); suggesting that the Big Five personality traits elucidate 76 percent of the variation in resilience. This paper measures resilience as the change in measures of mental well-being during the pandemic relative to before its outbreak.

The Five-Factor Model (FFM) is a multidimensional taxonomy of personality widely used and accepted across the empirical psychology and economics literature. This framework encompasses the following five independent domains: openness to experience, conscientiousness, extraversion, agreeableness and neuroticism. Individuals can be classified into these facets to varying degrees (Digman, 1990). Openness to experience is defined as the tendency to be open to new aesthetic, cultural or intellectual experiences and is characterised by traits of imagination, curiosity and un-conventional values (American Psychological Association, 2021). Conscientiousness is defined as the tendency to be organised, responsible and hardworking. Extraversion is defined as the orientation of one's interests and energies towards the outer world of people and things rather than the inner world of subjective experience. Agreeableness is defined as the tendency to act in a cooperative, unselfish manner. And finally, neuroticism is defined as a chronic level of emotional instability and proneness to psychological distress.

A further application is the classification of individuals in clusters based on the FFM (Asendorpf et al., 2001). In the majority of studies, three personality prototypes

have been found, labelled as 'resilients', 'overcontrollers', and 'undercontrollers'. 'Resilients' are characterised by their tendency to respond flexibly to changing situations. 'Overcontrollers' are identified by their tendency to strongly contain emotional and behavioural impulses. 'Undercontrollers', by contrast, exhibit weak control of their impulses. Whilst 'resilients' tend to be socially and cognitively adaptive, 'overcontrollers' tend to struggle with inhibition and 'undercontrollers' with higher antisocial behaviour. The association between the types and the big five is as follows, resilients score high in extraversion and low in neuroticism, 'overcontrollers' score low in extraversion and high in neuroticism, and 'undercontrollers' have low agreeableness and low conscientiousness.

This paper uses data from the British Millennium Cohort Study (MCS) to investigate the heterogeneity of mental health effects of the Covid-19 pandemic on adolescents by both personality types and personality traits. Surprisingly, we find that individuals classified as having a 'resilient' personality prototype in the literature (Asendorpf et al., 2001; Claes et al., 2006) experience a greater decline in their mental health than their peers. Subsequent analysis using personality traits identifies neuroticism scores as the main driver of the effect. Those with lower neuroticism scores were more affected by the pandemic than others. Our results suggest that worrying and being stressed are pathways through which neuroticism promotes mental health during the pandemic. Given these findings, we recommend that the UK government implement a policy of personality-specific mental health interventions.

The paper is organised as follows. Section 2 reviews existing theory and literature. Section 3 describes our data and Section 4 explains the empirical approach. Finally, Section 5 presents the results, Section 6 presents potential pathways and Section 7 concludes.

2 Literature Review

Our study contributes to multiple literature strands concerning personality traits and mental health resilience.

First, our paper adds to the growing body of literature describing the mental health impacts of Covid-19. For example, Siflinger et al. (2021) find evidence that mental health declined across all age groups in the Netherlands. Banks and Xu (2020) use a synthetic control to examine mental health effects in the UK, finding this adverse impact to have disproportionately impacted young adults. Similarly, Kocjan et al. (2021) find mental health outcomes deteriorated amongst Slovenes during the pandemic. Studying individuals aged 18 to 82, Kocjan et al. (2021) find increasing age to significantly increase subjective well-being. Our data allows us to explore the determinants of mental health outcomes for a group particularly affected by the pandemic.

Our second contribution is towards the literature on the association between the Big Five personality traits and both mental health and resilience. Many studies find that openness, conscientiousness, extraversion and agreeableness have a positive relationship with mental health, whilst neuroticism has a negative relationship (Anglim et al., 2020; Kocjan et al., 2021; Sahni et al., 2020). This paper tests the robustness of these relationships by performing numerous specifications using two measures of mental health. In addition, we observe personality traits pre-pandemic, eliminating possible endogeneity between personality and changes in mental health.

Meanwhile, several studies have reinforced the conjecture that openness, conscientiousness, extraversion and agreeableness are positively associated with resilience (Campbell-Sills et al., 2006; Friborg et al., 2005; Nakaya et al., 2006). However, these findings have not been universally established. For example, Kocjan et al. (2021) and Sahni et al. (2020) establish that extraverted individuals are not resilient during the Covid-19 pandemic, coinciding with the results of this paper. In the same manner

as neuroticism, these conflicting findings may be explained by the specific nature of the Covid-19 shock. The lack of social connections resulting from social distancing may make it difficult for extraverted individuals to build resilience (Harris et al., 2017; Swickert et al., 2002; Wilson and Dishman, 2015). This paper expands upon this proposition by examining the significance of suspending activities performed more habitually by less neurotic, as opposed to extraverted, individuals.

Third, we provide new evidence regarding the use of personality prototypes proposed in the literature. Previous authors have employed these to describe numerous outcomes, such as the risk of developing an eating disorder or other mental health problems (Claes et al., 2006; Bohane et al., 2017). In addition to the classification of 4,000 young adults into the clusters, we apply the clusters to examine heterogeneity in mental health outcomes between types. To the best of our knowledge, this is the first paper that examines the link between the personality prototypes and mental health resilience during the Covid-19 pandemic.

3 Data

3.1 Background

Although the Covid-19 threat emerged in January 2020 in the United Kingdom, the first national lockdown was implemented on 26 March and lasted until mid-June when restrictions began to be lifted gradually. Since then, two further national lockdowns were enforced in response to fears of surging cases. During the cohort wave of study of May 2020, individuals remained under the social distancing restrictions of the first national lockdown. In this period, the British public was instructed to remain at home except for ‘very limited purposes’. The Covid-19 stringency index for the UK which measures the severity of public health measures ranged between 70-80 out of a possible 100 at this time (Our World In Data, 2021). Meanwhile, during the September-October 2020 cohort wave of interest, the British public was given

more liberty, with a partial lifting of the lockdown measures. During this period, the stringency index ranged between 60-75 out of a possible 100.

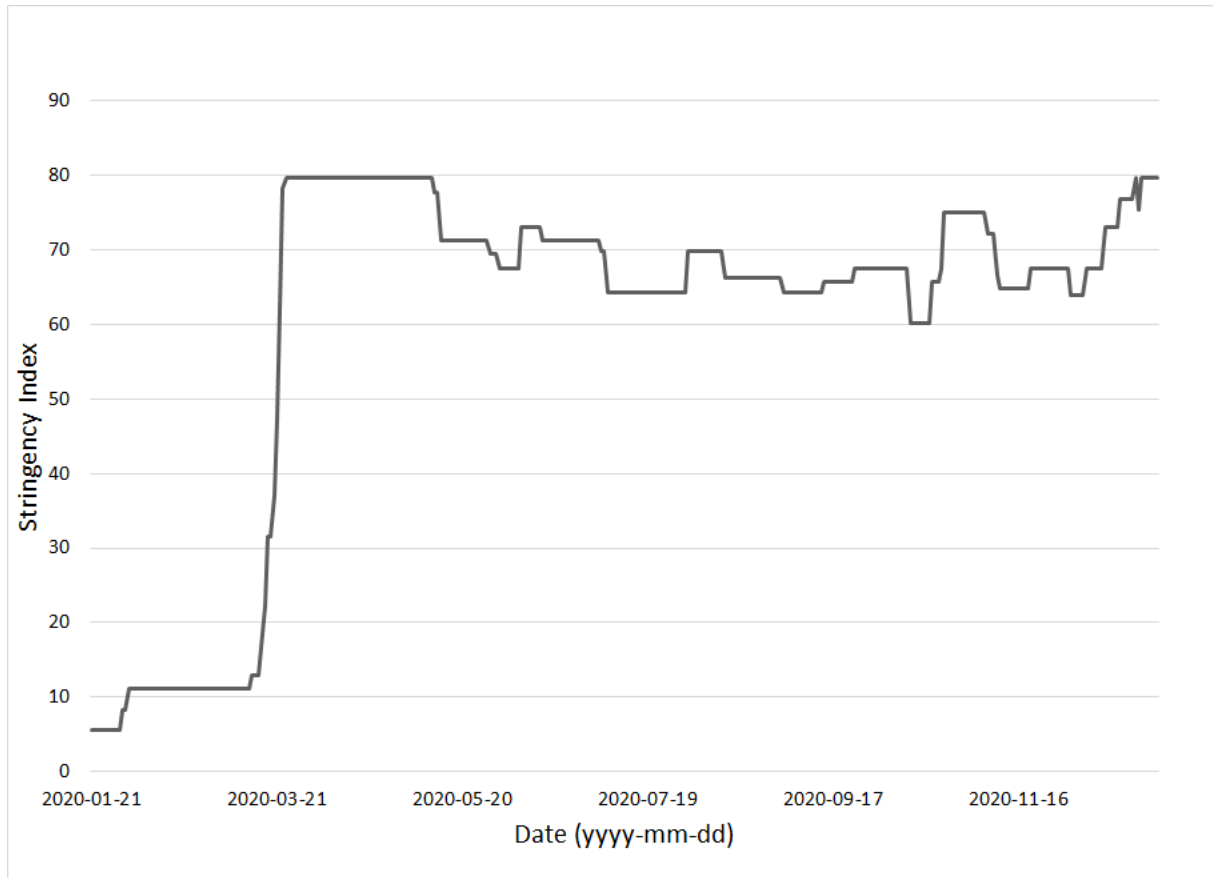


Figure 1: U.K. Stringency Index over Time

3.2 British Millennium Cohort Study

We obtain our data from the British Millennium Cohort Study (MCS) (Centre for Longitudinal Research, 2021), a longitudinal cohort study that follows a nationally representative sample of individuals born between the years 2000-02. The cohort waves of interest are the 2018, May 2020 and September-October 2020 waves. Both 2020 waves differ from the 2018 wave as they were intended to follow the effects of the Covid-19 pandemic on a fraction of all cohort members. As a result, there are

approximately 4000 unique individuals for which we obtain data in both the 2018 and at least one of the 2020 waves out of an original 19 000 cohort members.

Measures of the Big Five personality traits are obtained in the 2018 wave. Given our objective of examining the effect of pre-pandemic personality traits on mental health outcomes during the Covid-19 pandemic, obtaining data on personality traits during the Covid waves is not essential. More importantly, personality traits likely changed in response to the crisis caused by the pandemic (Sutin et al., 2020). Using measures of personality traits in the 2020 waves of the MCS could introduce a problem of endogeneity between mental health outcomes and personality. Data on personality traits in the 2018 wave of the MCS provides us with a solution as these measures are not influenced by the effects of the pandemic.

Mental health measures consist of the Kessler 6 psychological distress scale and the Warwick-Edinburgh Mental Well-being Scale (WEMWBS). The Kessler score is a self-reported measure of psychological distress which assesses mental illness in the general population (Kessler et al., 2002). The K6 is a popular measure that is notable for its brevity and strong psychometric properties. As an individual's Kessler score increases, their level of psychological distress will also increase thus leading to a decrease in mental health. For consistency, we reverse the Kessler score such that as an individual's Kessler score increases, their mental health increases. The WEMWBS is a measure of mental well-being which concentrates on the positive aspects of mental health (Tennant et al., 2007). The scale is suitable to monitor mental well-being at the population level due to its brevity and psychometric robustness. As an individual's WEMWBS increases, their assessed level of mental health will also increase. Table 1 presents descriptive statistics for both personality traits and mental health measures.

Table 1: Descriptive Statistics of Key Variables

Measure	2018			2020 (May)			2020 (Sep-Oct)			Min	Max
	Obs	Mean	σ	Obs	Mean	σ	Obs	Mean	σ		
Big Five traits											
Neuroticism	4,020	12.71	4.8	2,606	12.83	4.8	3,165	12.81	4.7	3	21
Openness	4,019	14.39	3.7	2,605	14.44	3.7	3,165	14.31	3.7	3	21
Agreeableness	4,021	16.89	2.9	2,606	16.99	2.9	3,166	16.86	2.9	3	21
Extraversion	4,011	13.22	4.0	2,600	13.28	4.0	3,161	13.03	4.0	3	21
Conscientiousness	4,014	14.33	3.2	2,604	14.49	3.1	3,160	14.30	3.2	3	21
Mental health indices											
Kessler	4,021	16.17	4.9	2,302	15.60	5.1	2,884	15.51	5.4	0	24
WEMWBS	4,006	22.24	3.9	2,306	21.25	3.9	2,893	21.35	4.0	7	35

4 Empirical Strategy

4.1 Personality Prototypes

First, we examine the Big Five personality traits for implicit clusters around certain personality prototypes. To match the existing literature, we follow their strategy closely. This facilitates comparison with our final clusters. Generally, a two-step clustering method is used to derive personality clusters (Asendorpf et al., 2001; Claes et al., 2006). First, we apply Ward’s linkage, an agglomerative clustering method, to the data. This method matches the two closest observations in terms of squared Euclidean distance. The algorithm then searches for the data points or clusters with the lowest distance between them. This continues until the specified number of clusters is reached.

A caveat of the Ward’s procedure is that observations or clusters that are matched in a previous step cannot be separated in subsequent steps. This is why a second step using non-hierarchical clustering is added. The cluster means from the previous step are inserted as initial centers for a K-means procedure. This procedure assigns all observations to the closest central point in terms of Euclidean distance. Based on this assignment, central points are computed for the new clusters and the procedure

is repeated until the centers only slightly differ from the previous central points.

To evaluate the robustness of the constructed clusters we randomly split our data into two subsamples. Each sample contains about 50 % of the observations. We follow the same two-step procedure to construct personality clusters. Then, we again classify both subsamples but using the central points of the first step of the other sample as inputs in the second step. In other words, individuals are then assigned to a cluster based on their Euclidean distance to the cluster centers of the other half of the sample. The agreement between the two clusters for each subsample is evaluated using Cohen's κ . An agreement of 0.6 is considered acceptable in this literature (Asendorpf et al., 2001). We assess the robustness of the three-, four-, and five-cluster solutions.

4.2 Specification

To estimate the relationship between mental health changes due to Covid-19 and personality, we run numerous specifications. Equation 1 describes our preferred specification:

$$Y_{it} = \beta * Covid_t * PersonalityMeasures_i + \gamma_t + \delta_i + \epsilon_{it}. \quad (1)$$

Y_{it} are the different mental health measures that we use as outcome variables. β is our parameter of interest and captures the effect on Y_{it} of the interaction between the Covid dummy and the personality measures. These measures are either the personality prototypes or the Big Five personality traits (standardised). The Covid dummy is an indicator variable taking the value of 1 for the May 2020 and September-October 2020 waves of the MCS. By interacting personality measures with Covid, we can include individual fixed effects capturing all fixed factors influencing personality and mental health. β will provide information on the relationship between the personality measures and the change in mental health between 2018 and 2020. Finally, we

include a Covid dummy to correct for the average decrease in mental health due to Covid.

Besides the specification above, which is the most demanding specification, we also estimate simple pooled OLS regressions. In these specifications, we not only include the personality-Covid interaction terms, but also the personality measures themselves. These added terms will enable us to infer the association between the Big Five and pre-Covid mental health status.

5 Results

5.1 Personality Prototypes

The averaged Cohen's κ for the three-, four-, and, five-cluster solutions are 0.62, 0.56, and 0.42, respectively. This is evidence that the agreement is acceptable for the three-cluster solution and approaches the threshold for four clusters. The five-cluster solution, used by for example Sava and Popa (2011), is not robust. Because the three-cluster solution has the highest agreement between the two classification methods and is more common in the literature, we decide to proceed with this solution.

The three personality prototypes we find are consistent with the literature: resilient, overcontrolled, and undercontrolled. Figure 2 shows the average standardised personality traits for each group. Resilient individuals have relatively low scores for neuroticism and above-average scores for the other four traits. Overcontrolled individuals, instead, have elevated scores for neuroticism, low scores for extraversion, and average scores for the other three traits. Finally, undercontrollers display particularly low scores in agreeableness and conscientiousness. These clusters closely match the ones found by Asendorpf et al. (2001) and Claes et al. (2006).

The division of young adults over the three clusters is relatively equal. In line with previous literature, the resilient/high-functioning cluster is the largest containing 1,559 individuals (39.0%). Another 1,354 classify as overcontrolled, making up

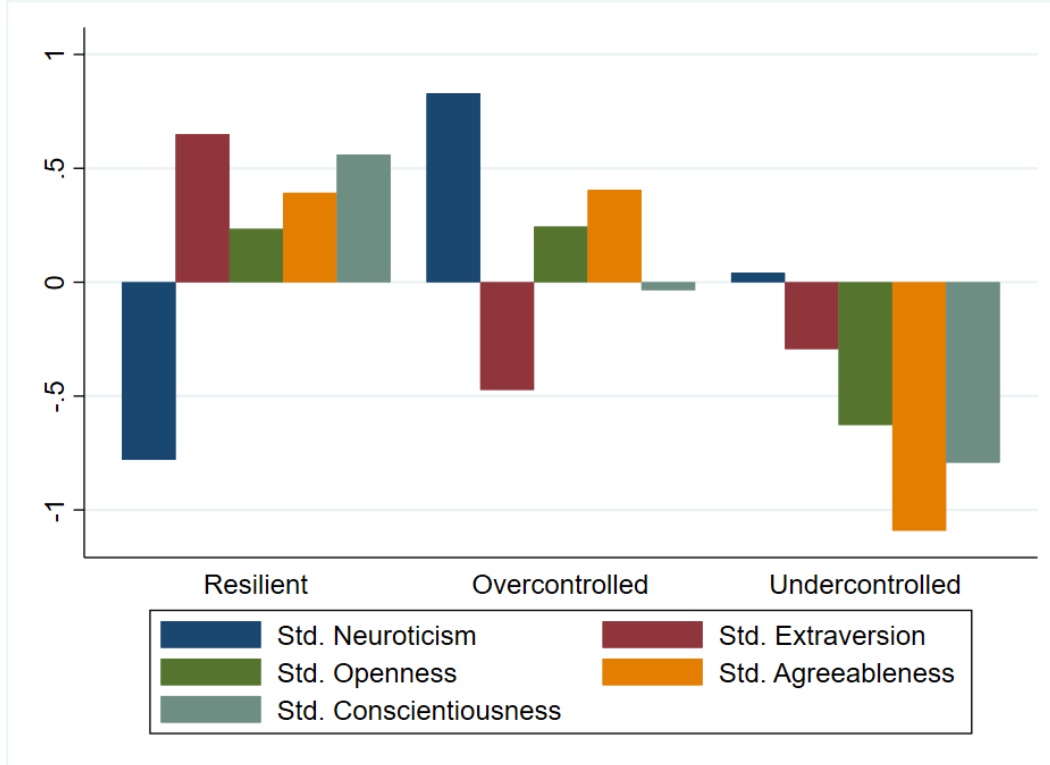


Figure 2: Average Standardized Big Five Personality Traits by Type

roughly a third of the sample (33.9%). The smallest cluster is that of the undercontrolled, although it still represents 1,082 individuals (27.1%).

5.2 Types and Mental Health During Covid

Table 2 presents our main results regarding personality types. Columns 1 and 2 use the Kessler score as the dependent variable, whilst columns 3 and 4 use the WEMWBS score. Our preferred specification, including individual fixed effects, is in columns 2 and 4. Interestingly, both undercontrolled and overcontrolled adolescents seem to fare better during Covid than the resilient type, the omitted category in this analysis. The size of the effect is substantial.

Overcontrolled individuals see a relative improvement, as compared to resilient people, of 1.6 in Kessler scores and 1.4 in WEMWBS. The magnitude of this coeffi-

cient is about 27.5% of the difference between the average Kessler score, 15.82, and the threshold for probable mental disorder, 10. The same applies to the WEMWBS, where the coefficient for Overcontrolled represents 30.4% of the distance between the average score and the threshold score for probable mental disorder.

Undercontrolled adolescents also do significantly better than those who are resilient, with relative improvements close to that of overcontrolled individuals. The difference between the coefficients for undercontrolled and overcontrolled individuals is therefore small, although the overcontrolled seem to do marginally better in the Kessler measure (significant at 10% level only).

Columns 1 and 3 report the difference in absolute mental health scores between the three types. Resilient individuals reported better mental health before the pandemic according to both measures. Our results, however, indicate that this difference decreases by about a third during the pandemic as the non-resilient types fared relatively well.

5.3 Big Five Personality Traits and Resilience

Although the finding that resilient individuals are relatively worse off during the pandemic is interesting by itself, it does not provide a clear image of which personality traits help mitigate the mental health impacts of Covid-19. In this section, we run the same specification but using personality traits rather than personality types as explanatory variables.

Table 3 presents our results for the personality traits, with column 2 describing our final model using the Kessler score and column 4 using the WEMWBS. The personality traits are standardised to ease interpretation. Again, we find that people with higher scores on neuroticism do relatively well during the pandemic compared to those with lower scores. Those with neuroticism scores of one standard deviation above the mean, score 0.78 and 0.66 points higher on the Kessler and WEMWBS

Table 2: Personality Types and Mental Health Changes

	Kessler		WEMWBS	
	<i>OLS</i>	<i>Fixed Effects</i>	<i>OLS</i>	<i>Fixed Effects</i>
Covid*Overcontrolled	1.541*** (0.222)	1.481*** (0.176)	1.435*** (0.174)	1.433*** (0.151)
Covid*Undercontrolled	1.056*** (0.248)	1.166*** (0.185)	1.623*** (0.190)	1.617*** (0.161)
Covid	-1.402*** (0.132)	-1.389*** (0.109)	-1.844*** (0.126)	-1.813*** (0.111)
Overcontrolled	-5.384*** (0.155)		-4.018*** (0.125)	
Undercontrolled	-3.725*** (0.171)		-4.082*** (0.134)	
Constant	19.00*** (0.0844)	16.14*** (0.0423)	24.71*** (0.0895)	22.22*** (0.0359)
Observations	9,106	9,106	9,107	9,107
R-squared	0.158	0.028	0.179	0.066
Time FE	✓	✓	✓	✓
Individual FE	-	✓	-	✓
Number of Individuals		3,995		3,991

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Note: Omitted categories are resilient (personality prototype) and the interaction term between Covid and resilience. Results for other types are relative to this category.

measures during the pandemic, respectively.

The results for the other personality traits are less clear. Only conscientiousness has a clear negative effect on mental health during Covid. The effect is about half the size of that of neuroticism. Agreeableness and extraversion seem to have a negative effect on mental health changes, if any. Openness has the most ambiguous effect, its interaction shows positive effects on the Kessler score but negative effects on the WEMWBS.

Again, columns 1 and 3 tell us about the association between the levels of the five personality traits and mental health pre-pandemic. Individuals with elevated scores for neuroticism or openness have significantly worse mental health than those with lower scores. The relationship between conscientiousness, extraversion and agreeableness with mental health, on the other hand, is positive.

Figure 3 displays the contribution of neuroticism on mental health outcomes pre and during Covid, for the Kessler score (figure 3a) and the WEMWBS (figure 3b). The negative slope of the lines indicates a negative association between neuroticism and mental health. In both graphs, we observe a shift in the level and the slope of the curve from 2018 to 2020. The level shift originates from the negative Covid dummy, indicating a general decrease in mental health. The slope becomes flatter through the positive coefficient on the interaction term between neuroticism and Covid. Compared to 2018, those with higher neuroticism fare better than others, mitigating the negative slope. For the Kessler score, our model predicts an increase in mental health for those in the top 20% of neuroticism. For WEMWBS, only those in the top 8% of neuroticism marginally improve their mental health during Covid. The largest decreases are for the individuals two standard deviations below the mean of neuroticism, decreasing 2 points in both scores compared to the average.

Table 3: Big Five Personality Traits and Mental Health Changes

	Kessler		WEMWBS	
	<i>OLS</i>	<i>Fixed Effects</i>	<i>OLS</i>	<i>Fixed Effects</i>
Covid*Neuroticism	0.686*** (0.0946)	0.683*** (0.0829)	0.600*** (0.0745)	0.660*** (0.0686)
Covid*Openness	0.0896 (0.0913)	0.0961 (0.0788)	-0.297*** (0.0733)	-0.303*** (0.0677)
Covid*Agreeableness	-0.158 (0.0991)	-0.166** (0.0832)	-0.280*** (0.0726)	-0.276*** (0.0685)
Covid*Conscientiousness	-0.246** (0.101)	-0.295*** (0.0893)	-0.381*** (0.0774)	-0.366*** (0.0732)
Covid*Extraversion	-0.228** (0.0942)	-0.234*** (0.0785)	-0.108 (0.0723)	-0.115* (0.0664)
Covid	-0.565*** (0.0873)	-0.569*** (0.0745)	-0.887*** (0.0681)	-0.887*** (0.0628)
Neuroticism	-2.705*** (0.0630)		-1.831*** (0.0500)	
Openness	-0.757*** (0.0602)		0.217*** (0.0511)	
Agreeableness	0.503*** (0.0639)		0.615*** (0.0496)	
Extravertness	0.510*** (0.0636)		0.464*** (0.0500)	
Conscientiousness	0.799*** (0.0666)		0.849*** (0.0530)	
Constant	16.14*** (0.0578)	16.14*** (0.0419)	22.22*** (0.0461)	22.22*** (0.0353)
Observations	9,106	9,106	9,107	9,107
R-squared	0.309	0.044	0.297	0.092
Time FE	✓	✓	✓	✓
Individual FE	-	✓	-	✓
Number of Individuals		3,995		3,991

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

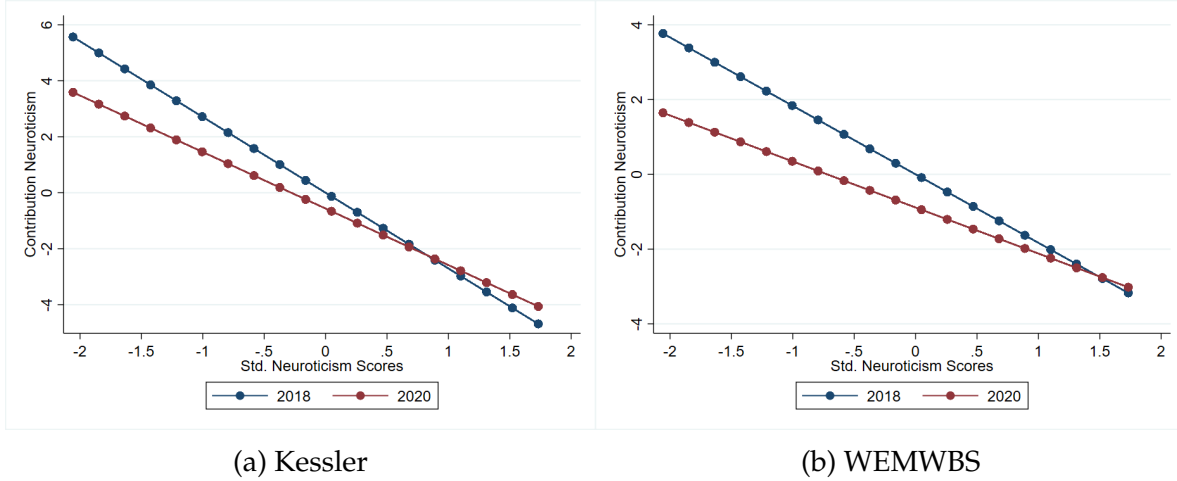


Figure 3: Predicted Contribution of Neuroticism to Kessler Score (a) and WEMWBS (b) in 2018 and 2020

5.4 Robustness Checks

Given the largely unprecedented results found for the effect of neuroticism on changes in mental health during the pandemic, further analysis will be devoted to this personality trait. A potential explanation for the results could be that some highly neurotic individuals already scored so poorly on certain mental health sub-questions that they could not attain a worse mental health score. This scaling effect would result in highly neurotic individuals performing better in terms of mental health scores relative to those with low neuroticism despite this not being an actual representation of reality. To formally test this explanation, we run our fixed effects regression with a restricted sample which excludes the top 10% and 25% of neurotic individuals. Excluding these individuals should reduce the possibility of there being a scaling effect. Table A1 presents the results of this robustness check. The coefficient for the interaction of neuroticism with the Covid dummy for both regressions remains positive and significant. This indicates that our results are not driven by a scaling effect but rather that increased neuroticism improves mental health outcomes during the pandemic.

Another potential caveat of our findings is that although those low in neuroticism face larger decreases in mental health, this effect could be concentrated in the top and middle parts of the mental health distribution. This would limit the relevance of our findings because it would imply that those with high neuroticism are still the ones more likely to display dangerously low levels of mental health post-pandemic. To test whether this is the case, we change our dependent variable to a dummy variable representing whether the individual exhibits dangerous levels of mental health. Reversed Kessler scores below 10 and WEMWBS below 18 are assigned a value of 1 to denote that these individuals are at risk of developing a serious mental illness (Prochaska et al., 2012; Tennant et al., 2007). We run our preferred fixed effects regression with these thresholds as dependent variables. Table A2 presents the results. The coefficient for the interaction of neuroticism and the Covid dummy is negative and significant, meaning that individuals with higher neuroticism are less likely to be at risk of developing a serious mental illness during the pandemic. This is in line with our previous results and demonstrates that the results for neuroticism are also driven by individuals in the top and middle of the mental health distribution.

5.5 Discussion

Our finding that highly neurotic individuals are the most resilient generally contradict the literature (Campbell-Sills et al., 2006; Friberg et al., 2005; Nakaya et al., 2006). However, this difference may have arisen from the various conceptualisations, and consequent measurements, of resilience. These papers, for example, use the Connor-Davidson Resilience Scale, the Resilience Scale for Adults and the Adolescent Resilience Scale respectively. These are constructed from items aimed to elicit respondents' ability to cope with stress and adversity. Consequently, although these scales measure cognitive and behavioural strategies that are adaptive in nature, they are assessed at a constant point in time. By contrast, this paper gauges resilience in

practice by analysing changes in mental states at different points in time.

Furthermore, as aforementioned, the relationship between personality traits and resilience may be susceptible to the nature of the shock. Sahni et al. (2020) conduct a cluster and stepwise analysis to explore the relationship between OCEAN personality traits and emotional resilience for adults in India during Covid-19. Their findings support the results of this paper that individuals high in neuroticism will be amongst those most resilient to the Covid-19 pandemic.

6 Pathways

The positive association between neuroticism and resilience during the pandemic is explained by the literature through the following mechanisms. Firstly, more neurotic individuals may habitually spend more time indoors as a result of their higher disposition to respond anxiously to stimuli. Since social distancing restrictions hindered outdoor activities as opposed to those indoors, one may expect highly neurotic individuals to have experienced less change in their subjective mental health. Secondly, highly neurotic individuals are characterised by their tendency to see neutral events and situations in a more negative light than their less neurotic peers, whilst ruminating more on negative past experiences or worrying more about future outcomes (Diener et al., 2003; Lahey, 2009). This tendency to be affected more by negative states of mind in neutral situations may explain why these individuals experience less change in their mental health when confronted with an external shock, such as the pandemic, relative to their less neurotic peers. Liu et al. (2021) conceptualise this tendency for highly neurotic individuals to be more detached from external situations as having greater perceptual distancing (Liu et al., 2021). Exploring these pathways for neuroticism may reveal which neurotic behaviours and activities promote mental health resilience to the effects of the pandemic.

Individual neuroticism scores are constituted from three sub-questions that as-

sess the tendency of individuals to partake in neurotic behaviours. The first of these questions assesses whether the individual is someone who worries a lot, the second whether she is someone who gets nervous easily, and the third whether she is someone who does not handle stress well. We interact these behaviours with the Covid dummy and include these interactions into our main fixed effects regression, replacing the neuroticism interaction term. Table A3 presents the results. When using the Kessler score as the measure of mental health, the results of this model demonstrate that the neurotic behaviour that drives the majority of the results is whether the person worries a lot. Whether the person gets nervous easily or does not handle stress well is not significant. When using the WEMWBS as the measure of mental health, whether the person worries a lot and whether they do not handle stress well are both the determining behaviours driving the results for neuroticism. The results therefore suggest that worrying and being stressed are pathways through which neuroticism promotes mental health resilience. Individuals high in neuroticism are prone to viewing events and situations in a more negative light, leading to a ruminative focus on negative experiences. By viewing daily occurrences negatively through excessive worry and stress, neurotic individuals may be preconditioned to react less to major negative events than those who are less neurotic.

Other potential pathways explaining the results found for neuroticism are the daily activities done by neurotic individuals. The Covid-19 pandemic led to the widespread cessation of social activities and this greatly affected communal life. However, if neurotic individuals were less likely to participate in these activities relative to those who were less neurotic, this could explain why neuroticism is associated with better mental health outcomes during the pandemic. Descriptive statistics demonstrate that neurotic individuals were less likely to attend parties, religious events, live sports and spend time with friends. All these activities were severely curtailed during the lockdown. Moreover, neurotic individuals were more likely to read for enjoyment, an activity that was not limited by the lockdown. This de-

scriptive evidence suggests that the positive effects of neuroticism on mental health during the pandemic could be driven by the fact that the activities neurotic adolescents engage in were relatively unaffected by the lockdown. Including the activities interacted with the Covid dummy in our main specification barely changes the coefficient on the neuroticism interaction. This implies that the activities do not explain the effect we find for neuroticism. Therefore, we can conclude that activities are not a pathway through which neuroticism affects mental health during the pandemic.

7 Conclusion

Mental health outcomes significantly deteriorated in the United Kingdom as a result of the Covid-19 pandemic, particularly for younger individuals. Poor youth mental health is of concern in and of itself, but it is especially alarming because of the obstacles it imposes on youth development. The Covid-19 emerged in the UK in January 2020 and led to a national lockdown in late March which lasted until mid-June. Given the unprecedented and exogenous nature of the shock, individual psychological reactions will reflect personality traits through the mechanism of resilience. This paper uses data from the MCS to investigate the heterogeneity of mental health effects of the Covid-19 pandemic on adolescents by both personality types and personality traits.

We find the three standard personality prototypes of the literature for a sample of adolescents in the UK. We are the first to examine the relationship between these personality types and the mental health effects of Covid-19. We find that resilient individuals, who generally have better mental health, reported larger decreases in mental health during the pandemic than both undercontrollers and overcontrollers. Additional analysis shows that the effect seems to be driven by the neuroticism trait included in the Big Five. Those with higher neuroticism scores fared better than those with lower scores during the pandemic. For the highest scores of neuroticism,

we even predict an increase in mental health scores.

Our findings highlight that personality traits are important factors in identifying stress-prone individuals during a pandemic. Therefore, our policy recommendation is for the UK government to implement a policy of mental health interventions that are personality-specific and targeted towards young people. Such interventions would begin redressing the imbalance in mental health caused by the pandemic. Although these efforts should include individuals who were at risk of mental disorders before the pandemic, our research demonstrates that those who were not at risk before the pandemic are more likely to become so. Therefore, we recommend that significant resources be devoted such that the mental health interventions can cover all adolescents.

Furthermore, by unveiling greater perceptual distancing as one of the potential channels for neurotic individuals' higher resilience, our research highlights the value of building positive mental health states irrespective of life circumstances. The practice of mindfulness, incorporating relaxation, meditation and non-judgmental observation, has recently gained recognition for its efficacy in fostering positive mental health (Wielgosz et al., 2019). Research has also established the effectiveness of mindfulness in mitigating depressive symptoms (Goldberg et al., 2019). Practicing mindfulness may prove especially crucial during negative shocks, such as public health crises, which can trigger the onset of depressive symptoms. Indeed, Zhu et al. (2021) find that those practicing mindfulness report lower Covid-19 pandemic-related distress relative to their non-practicing counterparts in China. Consequently, the National Health Service (NHS) could provide a free mindfulness app, for example, to promote more stable mental health for all individuals.

However, asserting that individuals with high neuroticism were resilient during the pandemic may be premature. Resilience implies the ability to adapt to stressful circumstances and therefore, it may be too early to make definitive conclusions given that the pandemic was still ongoing for the individuals in our data set. It is

conceivable that over time, individuals classified as resilient will experience a recovery in mental health outcomes that exceeds that of non-resilient types. Future research should reassess this question as more data emerges.

References

- Almlund, M., Duckworth, A. L., Heckman, J., and Kautz, T. (2011). Personality psychology and economics. In *Handbook of the Economics of Education*, volume 4, pages 1–181. Elsevier.
- American Psychological Association (2021). Openness. *APA Dictionary*.
- Anglim, J., Horwood, S., Smillie, L. D., Marrero, R. J., and Wood, J. K. (2020). Predicting psychological and subjective well-being from personality: A meta-analysis. *Psychological Bulletin*, 146(4):279.
- Asendorpf, J. B., Borkenau, P., Ostendorf, F., and Van Aken, M. A. (2001). Carving personality description at its joints: Confirmation of three replicable personality prototypes for both children and adults. *European Journal of personality*, 15(3):169–198.
- Banks, J. and Xu, X. (2020). The mental health effects of the first two months of lockdown and social distancing during the covid-19 pandemic in the uk. Technical report, IFS Working Papers.
- Bohane, L., Maguire, N., and Richardson, T. (2017). Resilients, overcontrollers and undercontrollers: a systematic review of the utility of a personality typology method in understanding adult mental health problems. *Clinical Psychology Review*, 57:75–92.
- Campbell-Sills, L., Cohan, S. L., and Stein, M. B. (2006). Relationship of resilience to personality, coping, and psychiatric symptoms in young adults. *Behaviour research and therapy*, 44(4):585–599.
- Centre for Longitudinal Research (2021). *Millennium Cohort Study, 2021*. UK Data Service.
- Claes, L., Vandereycken, W., Luyten, P., Soenens, B., Pieters, G., and Vertommen, H. (2006). Personality prototypes in eating disorders based on the big five model. *Journal of Personality Disorders*, 20(4):401–416.
- Diener, E., Oishi, S., and Lucas, R. E. (2003). Personality, culture, and subjective well-being: Emotional and cognitive evaluations of life. *Annual review of psychology*, 54(1):403–425.
- Digman, J. M. (1990). Personality structure: Emergence of the five-factor model. *Annual review of psychology*, 41(1):417–440.
- Fletcher, D. and Sarkar, M. (2013). Psychological resilience. *European psychologist*.

- Friborg, O., Barlaug, D., Martinussen, M., Rosenvinge, J. H., and Hjemdal, O. (2005). Resilience in relation to personality and intelligence. *International journal of methods in psychiatric research*, 14(1):29–42.
- Goldberg, S. B., Tucker, R. P., Greene, P. A., Davidson, R. J., Kearney, D. J., and Simpson, T. L. (2019). Mindfulness-based cognitive therapy for the treatment of current depressive symptoms: a meta-analysis. *Cognitive behaviour therapy*, 48(6):445–462.
- Gray, A. (2021). One-fifth of british adults report being depressed. *Financial Times*.
- Harris, K., English, T., Harms, P. D., Gross, J. J., Jackson, J. J., and Back, M. (2017). Why are extraverts more satisfied? personality, social experiences, and subjective well-being in college. *European Journal of Personality*, 31(2):170–186.
- Judge, T. A. and Zapata, C. P. (2015). The person–situation debate revisited: Effect of situation strength and trait activation on the validity of the big five personality traits in predicting job performance. *Academy of Management Journal*, 58(4):1149–1179.
- Kessler, R. C., Andrews, G., Colpe, L. J., Hiripi, E., D K, M., T NORMAND, S., WALTERS, E. E., and Zaslavsky, A. M. (2002). Short screening scales to monitor population prevalences and trends in non-specific psychological distress. *Psychological medicine*, 32(6):959.
- Kivimäki, M., Batty, G. D., Steptoe, A., and Kawachi, I. (2017). *Psychosocial epidemiology: Key concepts and methods*. Routledge.
- Kocjan, G., Kavčič, T., and Avsec, A. (2021). Resilience matters: Explaining the association between personality and psychological functioning during the covid-19 pandemic. *International Journal of Clinical Health & Psychology*, 21(1).
- Lahey, B. B. (2009). Public health significance of neuroticism. *American Psychologist*, 64(4):241.
- Liu, S., Lithopoulos, A., Zhang, C.-Q., Garcia-Barrera, M. A., and Rhodes, R. E. (2021). Personality and perceived stress during covid-19 pandemic: Testing the mediating role of perceived threat and efficacy. *Personality and individual differences*, 168:110351.
- Miller, M. W. and Harrington, K. M. (2011). Personality factors in resilience to. *Resilience and mental health: Challenges across the lifespan*, page 56.
- Nakaya, M., Oshio, A., and Kaneko, H. (2006). Correlations for adolescent resilience scale with big five personality traits. *Psychological reports*, 98(3):927–930.
- Our World In Data (2021). Stringency index. *Our World in Data*.

- Patel, V., Flisher, A. J., Hetrick, S., and McGorry, P. (2007). Mental health of young people: a global public-health challenge. *The Lancet*, 369(9569):1302–1313.
- Prochaska, J. J., Sung, H.-Y., Max, W., Shi, Y., and Ong, M. (2012). Validity study of the k6 scale as a measure of moderate mental distress based on mental health treatment need and utilization. *International journal of methods in psychiatric research*, 21(2):88–97.
- Roberts, B. W. (2009). Back to the future: Personality and assessment and personality development. *Journal of research in personality*, 43(2):137–145.
- Sahni, S., Kumari, S., and Pachaury, P. (2020). Building emotional resilience with big five personality model against covid-19 pandemic. *FIIB Business Review*, page 2319714520954559.
- Sava, F. A. and Popa, R. I. (2011). Personality types based on the big five model. a cluster analysis over the romanian population. *Cognitie, Creier, Comportament/Cognition, Brain, Behavior*, 15(3).
- Siflinger, B., Paffenholz, M., Seitz, S., Mendel, M., and von Gaudecker, H.-M. (2021). The covid-19 pandemic and mental health: Disentangling crucial channels.
- Sutin, A. R., Luchetti, M., Aschwanden, D., Lee, J. H., Sesker, A. A., Strickhouser, J. E., Stephan, Y., and Terracciano, A. (2020). Change in five-factor model personality traits during the acute phase of the coronavirus pandemic. *PloS one*, 15(8):e0237056.
- Swickert, R. J., Rosentreter, C. J., Hittner, J. B., and Mushrush, J. E. (2002). Extraversion, social support processes, and stress. *Personality and Individual Differences*, 32(5):877–891.
- Tennant, R., Hiller, L., Fishwick, R., Platt, S., Joseph, S., Weich, S., Parkinson, J., Secker, J., and Stewart-Brown, S. (2007). The warwick-edinburgh mental well-being scale (wemwbs): development and uk validation. *Health and Quality of life Outcomes*, 5(1):1–13.
- Wielgosz, J., Goldberg, S. B., Kral, T. R., Dunne, J. D., and Davidson, R. J. (2019). Mindfulness meditation and psychopathology. *Annual review of clinical psychology*, 15:285–316.
- Wilson, K. E. and Dishman, R. K. (2015). Personality and physical activity: A systematic review and meta-analysis. *Personality and Individual Differences*, 72:230–242.
- Zhu, J. L., Schülke, R., Vatansever, D., Xi, D., Yan, J., Zhao, H., Xie, X., Feng, J., Chen, M. Y., Sahakian, B. J., et al. (2021). Mindfulness practice for protecting mental health during the covid-19 pandemic. *Translational psychiatry*, 11(1):1–11.

Appendices

Table A1: Big Five and Mental Health Excluding Top Neuroticism

	Kessler			WEMWBS		
	All Individuals	Bottom 90%	Bottom 75%	All Individuals	Bottom 90%	Bottom 75%
Covid*Neuroticism	0.683*** (0.0829)	0.510*** (0.0979)	0.354*** (0.117)	0.660*** (0.0686)	0.591*** (0.0880)	0.534*** (0.108)
Covid*Openness	0.0961 (0.0788)	0.0388 (0.0829)	-0.00146 (0.0880)	-0.303*** (0.0677)	-0.375*** (0.0755)	-0.444*** (0.0833)
Covid*Agreeableness	-0.166** (0.0832)	-0.176** (0.0899)	-0.141 (0.0961)	-0.276*** (0.0685)	-0.302*** (0.0772)	-0.300*** (0.0847)
Covid*Conscientiousness	-0.295*** (0.0893)	-0.319*** (0.0956)	-0.243** (0.102)	-0.366*** (0.0732)	-0.410*** (0.0815)	-0.394*** (0.0873)
Covid*Extraversion	-0.234*** (0.0785)	-0.197** (0.0831)	-0.233*** (0.0876)	-0.115* (0.0664)	-0.0626 (0.0740)	-0.0638 (0.0802)
Covid	-0.569*** (0.0745)	-0.675*** (0.0836)	-0.809*** (0.0990)	-0.887*** (0.0628)	-0.927*** (0.0691)	-0.977*** (0.0813)
Constant	16.14*** (0.0419)	17.05*** (0.0438)	17.64*** (0.0460)	22.22*** (0.0353)	22.81*** (0.0386)	23.21*** (0.0416)
Observations	9,106	7,805	6,785	9,107	7,797	6,780
R-squared	0.044	0.047	0.053	0.092	0.103	0.115
Number of Individuals	3,995	3,433	2,996	3,991	3,429	2,993
Time FE	✓	✓	✓	✓	✓	✓
Individual FE	✓	✓	✓	✓	✓	✓

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table A2: Big Five Personality Traits and Probable Mental Disorder as measured by Kessler score and WEMWBS

	Kessler	WEMWBS
Covid*Neuroticism	-0.0250*** (0.00733)	-0.0140** (0.00668)
Covid*Openness	-0.00202 (0.00681)	0.0139** (0.00664)
Covid*Agreeableness	0.00142 (0.00748)	-0.00184 (0.00706)
Covid*Conscientiousness	0.0141* (0.00776)	0.00142 (0.00735)
Covid*Extraversion	0.0263*** (0.00718)	0.00828 (0.00661)
Covid	0.0333*** (0.00652)	0.0444*** (0.00591)
Constant	0.149*** (0.00368)	0.0828*** (0.00335)
Observations	9,106	9,107
R-squared	0.016	0.014
Number of newid	3,995	3,991
Time FE	✓	✓
Individual FE	✓	✓

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Note: We use as dependent variable a dummy taking the value of 1 if the individual is below the mental health threshold of having a probable mental disorder for each score. A negative coefficient means that one is less likely to have a probable mental disorder.

Table A3: Neuroticism Subquestions and Mental Health Changes

	Kessler	WEMWBS
Worried*Covid	0.313*** (0.0578)	0.204*** (0.0528)
Nervous*Covid	0.0457 (0.0593)	-0.149*** (0.0536)
Stressed*Covid	0.0476 (0.0539)	0.366*** (0.0455)
Covid*Openness	0.0531 (0.0809)	-0.267*** (0.0689)
Covid*Agreeableness	-0.169** (0.0838)	-0.218*** (0.0685)
Covid*Conscientiousness	-0.315*** (0.0894)	-0.377*** (0.0731)
Covid*Extraversion	-0.243*** (0.0814)	-0.233*** (0.0695)
Covid	-2.331*** (0.226)	-2.617*** (0.204)
Constant	16.14*** (0.0418)	22.22*** (0.0350)
Observations	9,106	9,107
R-squared	0.046	0.101
Number of Individuals	3,995	3,991
Time FE	✓	✓
Individual FE	✓	✓

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

*Note: We replace the Covid*Neuroticism interaction by the three subquestions used to compute the neuroticism score, interacted with Covid. The questions are whether the person feels worried, nervous, or stressed.*