



Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.



# Personality, gender, and age resilience to the mental health effects of COVID-19

Anita Staneva<sup>\*</sup>, Fabrizio Carmignani, Nicholas Rohde

Griffith University, Griffith Business School, Australia

## ARTICLE INFO

### Keywords:

Pandemic  
Mental health  
Personality  
Young adults

## ABSTRACT

**Rationale:** Understanding the impact of COVID-19 on different population cohorts and which personality traits affected individual's coping responses can help identify strategies to promote self-directed behaviours, thereby enhancing and maintaining individual's mental well-being.

**Objective:** Using longitudinal data for the UK, we examine the impact of the COVID-19 pandemic on individuals' mental well-being, focusing on age, gender, and personality traits as possible modifiers.

**Methods:** We explore the longitudinal nature of the data using individual fixed effects models, which implicitly control for unobserved time-invariant individual-level characteristics. Our sample is an unbalanced panel consisting of 373,555 person-years observations, observed from 2009 until June 2020.

**Results:** The negative impacts of the first months of the pandemic period are found to be larger for young adults (aged 16–25 years) and vary by personality traits. The increase in psychological distress symptoms is more pronounced for individuals who score higher in neuroticism, extroversion, and openness to experience. Indeed, for introverted young people, recent events may have actually brought a sense of calm. Other findings indicate that worsening in the psychological distress level occurs alongside with increased feelings of loneliness.

**Conclusions:** Our findings support the theoretical knowledge that different people have different psychological and behaviour responses and personality concepts can be used when studying individual's adaptive behaviour in critical situations such as COVID-19. Our results indicate the necessity of public health programmes to assist distressed young individuals.

## 1. Introduction

The mental health impact of COVID-19 and the associated closure and containment measures has been identified as an important area of research going forward (Holmes et al., 2020). Fear of illness, death and bereavement, social isolation, and lockdown measures appear to have amplified already existing social and psychological problems. These include relationship stresses, financial problems, mental symptoms and disorders, such as substance abuse, anxiety, panic, and suicide (Brooks et al., 2020). While data on these effects are still preliminary, a swath of empirical evidence has already emerged. For example, Banks and Xu (2020) find that, taking into account of pre-pandemic trajectories, mental health aggregates in the UK have worsened by 8.1% on average. Similarly, Davillas and Jones (2020) show that the prevalence of psychological distress increased from 18.3% to 28.3% between 2018 and April 2020.

In this article, we model the effects of the first months of COVID-19

pandemic on psychological distress of the UK population, focusing on age, gender, and personality as potential modifiers. There are several reasons why these types of interactive effects may be present. For example, while disruptions surrounding the COVID-19 pandemic were challenging for most people, young adults seem to have been particularly impacted. For young adults, the lockdown measures during the pandemic have added a new pressure to their already tumultuous lives. On the other hand, older people have higher mortality risk as their innate immune system, used to fight off new illnesses, weakens with age. This can then exacerbate the symptoms of anxiety amongst elderly. Much of the initial concern related to how older adults would respond to COVID-19 was based on how loneliness and isolation would be exacerbated as the lockdown measures were implemented (Vahia et al., 2020). Gender is also likely to play a role, as women and men have different stress responses (Stroud et al., 2002), they face differing fatality rates from the illness (Jin et al., 2020), and it is widely accepted that women have a more anxious temperament compared to men (Sediri et al.,

<sup>\*</sup> Corresponding author. Griffith Business School, Department of Accounting, Finance and Economics, Nathan Campus, Australia.

E-mail address: [a.staneva@griffith.edu.au](mailto:a.staneva@griffith.edu.au) (A. Staneva).

2020). Women have been more likely than men to report being worried about their finances, and more women than men reported feeling anxious, lonely, and hopeless due to the pandemic (Foundation, 2020).

Finally, personality plays a central role within the health domain as it influences all aspects of illness and stress coping process (Ferguson, 2013). Personality theory can be used to forecast intra-individual and collective outcome differences in terms of psychosocial and mental health responses, and well-being (Jerominus, 2015). Personality traits are predictive in the labour markets (Heckman et al., 2006) and are linked to both genetics and experiences (Plomin and Deary, 2015), and these factors have a potential for explaining how individuals perceive and experience the negative aspects of the COVID-19 crisis. Given exposure to the pandemic related stressors, understanding the role of individuals' psychological process and the way different population groups perceive the crisis is important at least for three reasons. First, it can lead to identification of at risk-groups as well as outlining possible treatment strategies and protective mechanisms under a stressful negative shock such as COVID-19. We may expect that neurotic and extroverted people are more vulnerable to mental disorders and more likely to suffer during the pandemic. Second, linking personality to mental health is of policy importance, as if individuals perceive and respond to the pandemic differently, public health treatment strategies can be personality-tailored accordingly. Third, behavioral responses to influenza pandemics can significantly influence the impact on public health costs (Teasdale et al., 2012). It was estimated that only during the period between 9–19 April 2020, on average, a compensation of £2.25 billion per day to offset the negative effect of the COVID-19 and social distancing policies was required (Simetrica-Jacobs, 2020).

The article makes several novel contributions. First, using longitudinal data for the UK over the period 2009–2020, we examine the impact of the pandemic on individuals' mental well-being. We compare the COVID-19 experiences of younger, prime, and older adults relative to their pre-pandemic experience to assess their relative risk of the psychological distress. The panel data allow us to track respondents over time and to control for individual specific unobserved fixed effects. Studies on COVID-19 health impacts focus on cross-sectional variation in the mental health. Since we (i) control for all time-invariant individual-specific heterogeneity, and (ii) the pandemic is highly likely to be an exogenous, we argue that our results demonstrate a causal relationship. Second, we provide further evidence on the impact of the COVID-19 on individuals' daily lives, health, and financial situation. Specifically, we explore a range of social and health behaviours that can potentially drive the psychological distress effects of the observed negative shock. Third, we highlight the age and gender differences in estimated psychological effects and the prevalence of psychological distress. Finally, our results contribute to a still growing literature that seeks to better understand resilience traits and behaviors in times of crises, and opens windows of opportunity for interventions to boost such skills. Understanding the personality dimensions that are protective in individual's coping responses can help in the identification of strategies to promote self-directed behaviours, thereby enhancing and maintaining individual's mental well-being.

Our findings confirm that the negative effects of the first months of the pandemic and lockdown measures in the UK are stronger for young adults, and particularly for young men. Other things being equal, the COVID-19 period increased the psychological distress scores of young men (aged 16–25) by 0.50 standard deviations. We also show that personality traits are influential moderators, with individuals high in extraversion, neuroticism and openness to experience having the largest negative effect sizes. This seems to confirm popular narratives concerning the types of individuals most vulnerable to social isolation and increased external stress. Our findings further indicate that worsening in the psychological distress levels of young adults can be partially attributed to a heightened feeling of loneliness and reduced health related behaviours, such as walking outdoors.

The remainder of the article is organized as follows. Section 2

discusses the relevant literature that motivates the role of personality as a determinant of individual's well-being. Section 3 introduces the data and outlines our empirical specification. Section 4 discusses the results. Conclusions and policy implications are presented in Section 5.

## 2. Relationships between personality and mental health in times of crisis

To explain why certain people are healthier than others, a wide variety of personality concepts and their relationships to health outcomes have been studied (Marshall et al. (1994); Joseph and Wood (2010); Josefsson et al. (2011)). Personality has acquired a central position in the protective mechanism under stress (Srivastava and Das, 2015), implying that when exposed to the same health threat, different people have different psychological and behavioural responses, as well as different prognosis and mortality (Ferguson, 2013). Coping mechanisms are brought into action to prevent, reduce, or avoid stressor-induced emotional distress. Thus, ultimately personality variables determine the choice of strategies that can be used (Lazarus, 1966). A high neuroticism score is considered as the strongest psychological risk factor in virtually all adverse social and mental health outcomes (Jerominus (2015); Ormel et al. (2013)). Cuijpers et al. (2010) estimate that the top 25% of the population with the highest neuroticism scores generate an estimated 80% of all mental health costs. The other personality traits are also found to have an impact. For instance, conscientious associates positively with problem-focused coping and other strategies like planning, restraint coping and acceptance of responsibility (Penley and Tomaka (2002); Connor-Smith and Flachsbart (2007)). Agreeableness is positively associated with social support seeking, active coping, planning and positive reappraisal, and negatively associated with self-blame, avoidance, and wishful thinking (Bakker et al., 2006).

In addition, the behavioral immune system theory (Schaller (2006); Murray and Schaller (2012)) may be helpful to understand the consequences of the COVID-19 pandemic. It refers to psychological mechanisms that act as a 'first line of defence' against infectious diseases. The activation of our inborn immune system is risky and energy intensive, which makes the prevention of infections the desired strategy. The system helps to reduce the risk of infection, via a combination of personality traits that are likely to decrease the risk of pathogen exposure, thus suggesting that psychological distress might stem from this system as a byproduct. The core of the behavioral immune system comprises lower levels of extraversion and openness to experience (Schaller, 2015) and higher levels of obedience and conformity (e.g., Murray and Schaller (2012)).

The literature on COVID-19 and its adverse health impacts is growing quickly. For instance, Aschwanden et al. (2020) suggest that neuroticism, extraversion, and conscientiousness are linked to psychological responses to the COVID-19. Carvalho et al. (2020) find that higher scores for extroversion were associated with lower means for social distancing. The authors also suggest that people who score high in extroversion experience more difficulty to follow the global recommendations and social distancing containment measures. In contrast, people who score high in conscientiousness are more likely to find it easy to adhere to the proposed containment measures. De Coninck et al. (2020) collect data of 1000 Flemish adults between March 17, 2020 and March 22, 2020 to analyse perceived vulnerability to disease and public health measures. The authors confirm that high agreeableness and emotional stability are related to higher support for public health measures. Similarly, Qian and Yahara (2020) report that personality traits, moral foundation, and ideology influence people's behavior toward COVID-19 in Japan. However, all these studies rely on cross-sectional data and lack to delegate the importance of changes in the mental health conditions/status as an explanation of reported effects. Thus, it is not possible to move from correlation between personality traits and responses to the COVID-19 pandemic to a statement about causality. The present study advances existing research and improves our knowledge

about the role of personality for changes in well-being during times of crisis in several ways. First, the longitudinal nature of the data employed allows us to make a more plausible causal claim. Second, we further extend the recent findings by Banks and Xu (2020) and Davillas and Jones (2020) by exploring a range of social and health behaviors that can potentially drive the psychological distress effects of the observed pandemic shock. Finally, our findings support the theoretical knowledge that different people have different psychological and behavior responses and personality concepts can be used when studying individual's adaptive behaviour in critical situations such as COVID-19.

### 3. Data and empirical methodology

#### 3.1. Data

We use panel data from the UK Household Longitudinal Survey (UKHLS), known as 'Understanding Society'. The study began in 2009 and included around 36,000 individuals in the latest wave 9. Households recruited at the first round of data collection are visited each year to collect information on changes to their household and individual circumstances. From April 2020, participants of the UKHLS were asked to complete an online survey that aimed to examine the impact of the COVID-19 pandemic. This survey includes the General Health Questionnaire (GHQ-12), as well as information on demographics, and economic conditions in February 2020 (just before the start of the pandemic), followed by monthly waves in April, May, and June 2020. The analysis covers the first months of the pandemic, when the daily count of diagnosed and deceased individuals increased significantly (see Fig. 1). As more recent waves of data become available, we test the sensitivity of our results by combining all eight waves of the Covid-19 Survey (April, May, June, July, September, November 2020, January and March 2021) with waves 8 and 9 of the main survey (2017–2019), which allows us to track individuals over a longer course of the pandemic. Results remain robust to the main findings reported in this article.

Our main variable of interest is mental well-being, derived from a Likert-type index that sums 12 questions from the General Health Questionnaire (GHQ-12). The GHQ battery, constructed using questions related to individual's ability to concentrate, loss of sleep and enjoyment of day-to-day activities, whether individuals felt constantly under strain, or have difficulties of making decisions, is designed to capture individual's psychological distress and mental well-being (see Etheridge and Spantig (2020)). Following standard conventions (see Cox et al. (1987)), the overall value of the GHQ-12 (Likert) measure is computed by assigning values 0 to 3 for each of the four possible response categories to each item, and hence arriving at an index with values between

0 (least distressed) and 36 (most distressed). The GHQ-12 instrument from this survey has been widely used (e.g. Davillas et al. (2016); Davillas and Jones (2020)). Importantly, the GHQ questionnaire has been administered in a consistent way in all waves of the UKHLS as well as in the COVID-19 survey. We standardize this score across all waves to a distribution with zero mean and unit variance.

In wave 3 of the UKHLS, which was conducted between 2011 and 2013, individuals were asked questions to elicit their Big-Five personality traits. Respondents were asked to indicate by self-report the degree to which different adjectives describe them, on a scale from 1 ('not at all') to 7 ('very well'). We utilise the following traits: (1) extroversion – an orientation of one's interests and energies toward the outer world of people and things rather than the inner world of subjective experience; (2) agreeableness – the tendency to act in a cooperative manner with optimistic view of human nature; (3) conscientiousness – the tendency to be organized, responsible and hard-working; (4) neuroticism – the opposite of emotional stability – a chronic level of emotional instability and proneness of psychological distress; (5) openness to experience – the tendency to be open to new aesthetic, cultural, or intellectual experiences (Wichert and Pohlmeier, 2010). A limitation of the study is that personality traits are observed in one wave only and therefore we are not able to test the stability of these dimensions especially amongst adolescents. It is common in the existing literature to assume personality traits to be stable amongst respondents, and hence time-invariant (see John et al. (2010)). For instance, neuroticism is moderately heritable, with genetic factors determining 50–60% of their variance (Jang et al., 1996). This implies that personality traits are not driven by the outcome of interest, i.e. mental well-being, and be deemed as plausibly exogenous. However, we do not aim to include these personality traits as covariates in our model, rather we split the observed sample by specific personality traits conditional on gender. As our models allow for flexible relationship between psychological distress and age, we do not partition conditional on personality based on age. Specifically, 'low' and 'high' in neuroticism corresponds to samples of males and females that fall below, and above, or equal to the median for that personality trait, respectively. Thus, females in our sample report having a higher level of neuroticism (mean = 3.8; median = 4) than do males (mean = 3.2, median = 3). Similarly, females report higher level of agreeableness and conscientiousness compared to males, which is in line with the gender differences documented in the literature (see Feingold (1994); Costa et al. (2001); Nordman et al. (2019)).

To analyse the change in individual's daily life and financial circumstances by which the Covid-19 might influence the psychological distress, we consider variables for individuals reporting usual number of cigarettes smoked per day, the degree of individual financial hardship, feelings of loneliness and whether they exercise regularly. For the data

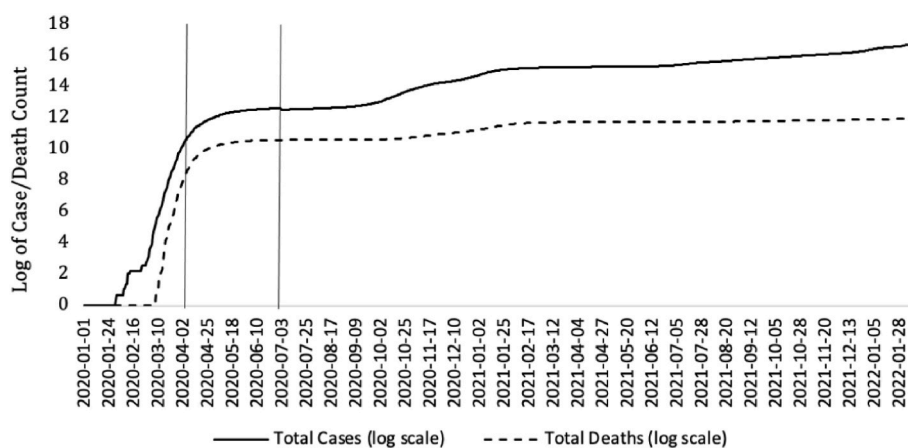


Fig. 1. Cumulative number of COVID Cases and Deaths in the UK. Notes: The data are presented into logarithmic scale. Source: Coronavirus Pandemic (COVID-19). Published online at [OurWorldInData.org](https://www.ourworldindata.org).

on financial hardship the specific question is: ‘How well would you say you are managing financially these days? Would you say you are living comfortably, doing alright, just about getting by, finding quite difficult, and finding it very difficult’. The variable ‘financial difficulties’ takes on the value 1 if respondents answer that find ‘quite difficult and very difficult’ to manage financially. In addition we further examine whether the estimated effects differ according to household income. For the data on loneliness, individuals state how often they feel lonely: hardly ever or never, some of the time and often. In each wave, respondents are also asked how often they participate in physical activities. If they walk outdoor at least 30 min or more, the variable ‘walking > 30’ is assigned a 1, otherwise the value is 0.

A few sample restrictions are applied in the empirical analysis. We include individuals aged between 16 and 95 observed from 2009 until June 2020, who responded to the measures of psychological distress questions in any waves. Observations with missing information on core variables in this study are dropped. Our final sample is an unbalanced panel consisting of 373,555 person-years observations, based on 41,363 females and 35,158 males. Specifically, we included individuals who responded to the measures of psychological distress in any waves of available data – total 389,703 person-year observations. This was further reduced to 373,555 person-year observations after dropping observations with missing information on age and region of residence. We further checked the robustness of our results by restricting the sample to individuals who responded to the COVID-19 module only, and were previously observed in waves 3, 8 and 9 of the annual sample. We constructed a balanced panel consisting of 10,300 individuals (6029 females and 4271 males). Results available upon request confirm our main findings.

Descriptive statistics for the resulted sample used in our study are presented in Table 1. The psychological distress index, as measured by the GHQ-12, shows that both males and females observed an increase in their distress level in 2020, where the increase was more pronounced for women. Among the respondents interviewed in the COVID waves, the mean GHQ-12 is reported at 13.14 for women and 11.29 for men,

respectively. In terms of personality traits, women score relatively higher on most of the traits, and men tend to be more opened to experience. We also observe that the respondents were less likely to exercise during the first months of 2020 when compared to the previous waves, however, they were also less likely to experience financial difficulties, potentially due to increases in government transfer payments.

### 3.2. Empirical methodology

Our primary strategy is to explore the longitudinal nature of the data using individual fixed effects models, which implicitly control for unobserved time-invariant individual-level characteristics. Our empirical analysis that relates an individual’s well-being to the health shock is based on the following specification:

$$y_{it} = \sum_{j=1}^6 \delta_j Covid_t \times Age_{ijt} + \sum_{j=1}^6 \varphi_j Age_{ijt} + \mathbf{X}'_{it} \gamma + a_i + \epsilon_{it} \quad (1)$$

where  $y_{it}$  is the standardized measure of the GHQ-12 psychological distress (mental well-being) for individual  $i$  in time  $t$ ;  $Covid_t$  is an indicator dummy that takes a value of 1 for the COVID-19 shock three waves of data (the months of April, May and June 2020) and 0 indicates the period of wave 9 main survey, related to period 2017–2019. The annual wave effects correspond to waves 1 to 8;  $Age_{ijt}$  refers to the following age categories (age 16–25, age 25–35, age 35–45, age 45–55, age 55–75 and age 75–95),  $\mathbf{X}_{it}$  captures time-varying observed explanatory variables such as regional and wave dummies;  $a_i$  is an individual specific fixed effect; and  $\epsilon_{it}$  is an idiosyncratic error term assumed to be independent from  $\mathbf{X}_{it}$  and  $a_i$ .

Here we allow the effects of the health crisis to vary across different age groups of respondents. The fixed effect estimator is identified by within-person variation in covariates over the observed period. The individual fixed effect  $a_i$  permits individual differences in the scale of the wellbeing index. In this specification, the interaction coefficients of  $Covid_t$  and  $Age_{ijt}$ ,  $\delta$ , measure the average within-age change in the psychological distress with the move to the pandemic period, conditional on

**Table 1**  
Summary statistics of resulting sample.

	Females		Males		Females		Males	
	< 2019	2020	< 2019	2020	< 2019	2020	< 2019	2020
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Psychological distress	11.58	[5.75]	13.14	[6.24]	10.43	[5.15]	11.29	[5.52]
Age 16–25	0.14	[0.35]	0.09	[0.28]	0.15	[0.36]	0.06	[0.23]
Age 25–35	0.15	[0.36]	0.11	[0.32]	0.14	[0.34]	0.09	[0.28]
Age 35–45	0.18	[0.39]	0.16	[0.37]	0.18	[0.38]	0.14	[0.35]
Age 45–55	0.18	[0.38]	0.21	[0.41]	0.18	[0.38]	0.2	[0.40]
Age 55–75	0.27	[0.44]	0.37	[0.48]	0.29	[0.45]	0.43	[0.49]
Age 75–95	0.07	[0.25]	0.05	[0.23]	0.07	[0.25]	0.08	[0.28]
Financial difficulties	0.10	[0.29]	0.05	[0.22]	0.09	[0.28]	0.04	[0.21]
Felling lonely	1.49	[0.66]	1.5	[0.64]	1.38	[0.61]	1.31	[0.54]
Smoking	1.79	[5.20]	0.99	[4.01]	2.26	[6.31]	1.14	[4.58]
Walking > 30	0.87	[0.34]	0.77	[0.42]	0.86	[0.35]	0.76	[0.43]
Time-invariant characteristics								
Extraversion		4.71	[1.31]		4.44	[1.27]		
Neuroticism		3.82	[1.44]		3.22	[1.36]		
Agreeableness		5.79	[0.98]		5.43	[1.06]		
Conscientiousness		5.57	[1.09]		5.38	[1.09]		
Openness to exp		4.47	[1.33]		4.67	[1.26]		
White		0.86	[0.35]		0.86	[0.35]		
Black		0.04	[0.20]		0.04	[0.18]		
Indian		0.03	[0.17]		0.04	[0.19]		
Pakistan/Bangladesh		0.04	[0.19]		0.04	[0.19]		
Other ethnic groups		0.03	[0.17]		0.03	[0.16]		
No qualification		0.23	[0.42]		0.24	[0.43]		
Degree		0.37	[0.48]		0.34	[0.47]		
A-level		0.12	[0.32]		0.12	[0.33]		
O-level		0.27	[0.44]		0.27	[0.44]		
Other qualification		0.02	[0.15]		0.02	[0.15]		



the other observed time-varying covariates. We cluster standard errors at the primary sampling unit level to allow for arbitrary correlation of unobservables within the household.

### 3.3. Heterogeneous effects of personality traits

We further explore the idea that the effects of psychological shock may vary systematically with the personality traits of individuals. Two primary hypotheses have been aired: that (i) a strong emotional dependence on personal interaction could be disadvantageous while social distancing, and (ii) neuroticism, or sensitivity to negative emotion, may aggravate stresses associated with ill health, bereavement or economic loss. Thus, persons with higher levels of either of these personality traits may be more severely affected by the crisis.

To allow for the heterogeneous effect of personality traits, we estimate eq. (1) for different sub-samples of individuals. We assume a person who scores low on neuroticism is seen as more emotionally stable, resilient, and less anxious. Furthermore, individuals who score low on conscientiousness have more difficulty staying organized and focused. Introverted individuals tend to avoid social situations and are more comfortable with small groups of people, and finally people who score low on the agreeableness trait are considered as less friendly and cooperative. We are aware that this selection might be to some extent arbitrary. Classifying individuals on a single trait, may be problematic as individual's behaviour phenotype can be composed of multiple axes of personality traits. We may expect, that individuals differ in their degree of sociability are different at the same time on their neuroticism. We experimented with an analogue Finite Mixture Model that aims to handle the heterogeneity associated with personality. Our results, available upon request, remain consistent.

### 3.4. The COVID-19 and change in individuals' daily life and financial situation

Finally, we expect the pandemic crisis to change several aspects of individuals' daily life and financial situation that could potentially contribute to the observed psychological distress effects. In particular, the lockdown already has resulted in widespread job losses and the UK economy is likely to face a recession. A lack of adequate resources may reduce an individual's ability to cope with life events, which may in turn increase the psychosocial distress (Adler et al. (1994); Haushofer and Fehr (2014)). Hence, we expect individuals to be financially affected by the crisis, which in turn could have an impact on their psychological well-being. In addition, smoking habits have also been found to have an association with individuals' well-being, with smokers having higher neuroticism and anxiety traits than non-smokers (McCrae et al., 1978). Moreover, physical activity especially during leisure time provides large health benefits and is associated with lower brain pathology (Gordon et al., 2008). As long as Government guidelines on social distancing were followed, people in the UK were allowed to leave their homes to walk/exercise once per day. We hypothesise that spending some time outdoors is helpful for physical and psychological distress. Finally, increasing attention in the literature has been paid to loneliness that contributes negatively to the well-being (Hawkley and Cacioppo (2010); Holt-Lunstad et al. (2015)).

To examine the potential changes in individual's daily life and financial situation that could drive the association between pandemic shock and psychological distress, we rely on the same strategy and estimate the models by focusing on the role of several time-varying outcomes. For this part of the analysis the outcome variables are: i) degree of financial hardship, measured by individual's subjective financial situation; ii) whether individuals smoke; iii) whether they exercise, measured by walking more than 30 min daily, and iv) whether they feel lonely. The set of explanatory variables  $X_{it}$  refers to the same set of controls used in our main Eq. (1).

## 4. Results

### 4.1. Main results

Table 2 reports the results for the FE estimator for both females and males. As our main analysis is based on FE models, we reduce the number of time-varying covariates included in the specifications to 'strictly exogenous'. Specifically, all specifications include in addition region of residence controls. We provide some robustness checks based on an extended specification that includes an indicator for long-term health complaints. As shown in Table 2, it is evident from the interaction results that following the pandemic, all age groups were more likely to experience psychological distress, and the effect is found stronger for younger adults. Other things being equal, the COVID-19 pandemic increased the psychological distress of young females and males (aged 16–25) relative to their pre-pandemic state by 0.45–0.50 standard deviations, respectively. Young men, in particular, are found to struggle more. The estimated COVID-19 interaction terms for both males and females are positive and statistically significant for other age groups, although the magnitude tends to decrease with age. This supports some previous findings that older adults tend to have lower stress reactivity and better emotional regulation than younger adults (see Lee et al. (2019)). There is some concern about the psychological distress, however, for older females. In particular, we do observe the effect for women aged 55 and over to be higher in magnitude when compared to the same age group males, suggesting that older women appear to be at a greater risk of COVID-19 related mental health complaints.

Our findings that younger adults are more likely to experience psychological distress are consistent with the previous literature (see Banks and Xu (2020)). The recent figures by the Office for National Statistics (Williams et al., 2020) also report that young people (aged 16–29 years) were more likely to report feeling lonely, stressed or anxious (72%) than those aged 60 years and over (54%). The results based on the FE regression model may not reflect the causal effect of COVID-19 on psychological distress level if there are time-varying latent factors which influence the outcome and are correlated with the COVID shock. These factors may reflect aspects of individual health, cognitive functioning or perhaps dimensions of social capital. A change in individual's health behaviour or some other conditions might cause a change in individuals' psychological distress level. However, these are unlikely to be the driving forces behind the COVID-19 pandemic; hence, the risk of

**Table 2**  
Effect of Covid shock on psychological distress by gender – FE model.

	z-psychological distress	
	Females	Males
Covid × Age 16-25	0.448*** (0.050)	0.509*** (0.072)
Covid × Age 25-35	0.431*** (0.036)	0.330*** (0.045)
Covid × Age 35-45	0.356*** (0.029)	0.316*** (0.034)
Covid × Age 45-55	0.247*** (0.024)	0.199*** (0.027)
Covid × Age 55-75	0.211*** (0.015)	0.117*** (0.015)
Covid × Age 76-95	0.321*** (0.038)	0.148*** (0.034)
Individual FE	Yes	Yes
Observations	208,954	164,601
Individuals	41,363	35,158

Notes: Standard errors clustered at primary sample unit level are in parentheses. \* $p < 0.10$ , \*\* $p < 0.05$ , \*\*\* $p < 0.01$ . The specification additionally includes region of residence dummies (12 regions in the UK with omitted category North Ireland), age effects with age 16–25 as omitted category. Outcome is standardized psychological distress. 'Yes' refers to individual fixed effects (FE) included.

time-varying confounding in our analysis is low, and we consider our estimates support the notion of a causal relationship.

4.2. Heterogeneous effects

Moving forward, as our main interest is in the effect of the COVID-19 on psychological well-being and whether personality traits may have an interacting effect on the observed relationship, we extend our estimations by estimating eq. (1) for different sub-samples of individuals as described in section 3.3.

Tables 3 and 4 provide results for both females and males by different personality traits. As evident from the results, there is consistent evidence that personality traits do modify our parameter estimates. Although both men and women appear to experience an increase in their psychological distress symptoms following the pandemic months, for young males (aged 16–25) this increase is more apparent for the group who score high in neuroticism. Specifically, the results illustrate that relative to their pre-pandemic experience, the first months of the pandemic increased the psychological distress of young men who score high in neuroticism by 0.78 standard deviations (see Table 4). This finding is consistent with emotional regulation playing a moderating role in whether psychological well-being change after the COVID-19 pandemic months. It also suggests that emotional stability can be a buffer against negative exposures such as the pandemic shock. The effects are still significantly different from zero for all other age groups, and for older women the lower neuroticism group relates to a lower incidence of psychological distress compared to those who score high in neuroticism. Specifically, the psychological distress increased by 0.23 and 0.40 standard deviations for those females aged 75 and over in high and low neuroticism group, respectively.

Further, extroversion is another trait that shows strong pattern in the psychological distress outcome. In the literature, there is a controversy regarding the association between the extroversion trait and mental health during the pandemic. One strand of researchers argue that the lifestyle associated with social distancing during the pandemic might feel more unusual to extroverts than to people who score lower in extroversion, as individuals who score higher in extroversion trait tend to be more energized by social interactions and seek the company of others when stressed (Wijngaards et al., 2020). Therefore, one could expect the adverse effect of the pandemic on psychological distress to be stronger for individuals who score higher in extroversion compared to individuals who score lower in extroversion. Conversely, some studies propose that extroverts are more capable of adjusting to the sudden

life-changing events, experience more positive affect, and keep their positive affect longer than introverts, especially in more emotionally distressing situations (Steel et al., 2008). Our findings line up with the first strand of this research and show that being low in extraversion (i.e., more introverted) could be beneficial in situations of social isolation. We find no significant impact on the psychological distress of introvert young men (aged 16–25), whereas the psychological distress increases by 0.59 standard deviations compared to the pre-pandemic period for extrovert young men. A higher increase in psychological distress is also found for older extroverted men (aged 76 and over) when compared to the introverts, 0.09 and 0.15 standard deviations, respectively (see Table 4). Similarly, we do observe that the negative effect of the COVID-19 and related social distancing regulations may have a stronger impact on young adults who self-assess as more open to experience. The magnitude of the estimated effects is greater for both males and females who score high in the openness to experience trait.

The conscientiousness trait that taps into persistence, self-discipline and the ability to self-regulate the emotional experience (Komulainen et al., 2014) also appears to be an important factor in predicting psychological distress. In addition, young men who score low in the conscientious trait seem to have struggled more during the first months of the pandemic. Specifically, their psychological distress scores increased by 0.44 standard deviations while the effect, higher in magnitude, is insignificant for more conscientious males. This finding is in line with Connor-Smith and Flachsbart (2007); John et al. (2010); Moffitt et al. (2011), who report that highly conscientious individuals have more successful coping behaviours. Finally, a significant increase in the psychological distress is found for young men and women who score high in agreeableness (i.e., sympathetic, kind, cooperative, and warm). Other things being equal, the first months of the pandemic have increased the psychological distress of young (age 16–25) high agreeable women and men by 0.51 and 0.71 standard deviations, respectively. For less agreeable young women the effect is insignificant. For males in all other age groups, no specific patterns were observed, as both low and high agreeableness groups appear to be responding approximately equally to the crisis.

In relation to older adults, for both men and women in the age categories 45 and over, being low in neuroticism and extroversion appears helpful in coping with the pandemic, as they report less psychological distress levels compared to the high neuroticism and extroversion groups. Similarly, the effect is less pronounced for women aged 55–75, who rate themselves as low in conscientiousness.

We should acknowledge the complexity of the Big-Five traits in

**Table 3**  
The effect of COVID shock on psychological distress by personality traits – Women (FE model).

	Low in neuroticism	High in neuroticism	Introverted	Extroverted	Low in openness	High in openness	Low in conscientiousness	High in conscientiousness	Low in agreeableness	High in agreeableness
Covid × Age 16–25	0.374*** (0.144)	0.469** (0.197)	0.308* (0.170)	0.491*** (0.164)	0.218 (0.138)	0.521*** (0.187)	0.365*** (0.137)	0.465* (0.242)	0.231 (0.192)	0.508*** (0.150)
Covid × Age 25–35	0.329*** (0.074)	0.414*** (0.052)	0.396*** (0.056)	0.357*** (0.067)	0.371*** (0.058)	0.394*** (0.062)	0.365*** (0.056)	0.412*** (0.067)	0.428*** (0.068)	0.349*** (0.054)
Covid × Age 35–45	0.259*** (0.050)	0.375*** (0.041)	0.319*** (0.041)	0.342*** (0.041)	0.319*** (0.044)	0.338*** (0.049)	0.376*** (0.048)	0.293*** (0.041)	0.288*** (0.052)	0.359*** (0.039)
Covid × Age 45–55	0.221*** (0.036)	0.226*** (0.034)	0.197*** (0.041)	0.244*** (0.032)	0.198*** (0.035)	0.246*** (0.036)	0.181*** (0.041)	0.247*** (0.032)	0.254*** (0.048)	0.209*** (0.030)
Covid × Age 55–75	0.170*** (0.022)	0.176*** (0.025)	0.169*** (0.025)	0.184*** (0.023)	0.157*** (0.024)	0.190*** (0.024)	0.174*** (0.028)	0.174*** (0.021)	0.164*** (0.031)	0.181*** (0.020)
Covid × Age 76–95	0.227*** (0.046)	0.396*** (0.065)	0.268*** (0.057)	0.330*** (0.052)	0.295*** (0.053)	0.309*** (0.057)	0.280*** (0.051)	0.341*** (0.059)	0.338*** (0.073)	0.292*** (0.045)
Individual FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	67,683	141,271	68,707	140,247	79,162	129,792	68,875	140,079	53,406	155,548
Individuals	9516	31,847	9695	31,668	11,308	30,055	10,020	31,343	7608	33,755

Notes: Standard errors clustered at primary sample unit level are in parentheses. \**p* < 0.10, \*\**p* < 0.05, \*\*\**p* < 0.01. The specification additionally includes age categories dummies (with age 16–25 as omitted category) and region of residence dummies (12 regions in the UK with omitted category North Ireland). Outcome is standardized psychological distress. ‘Yes’ refers to individual fixed effects (FE) included.

**Table 4**

The effect of COVID shock on psychological distress by personality traits – Men (FE model).

	Low in neuroticism	High in neuroticism	Introverted	Extroverted	Low in openness	High in openness	Low in conscientiousness	High in conscientiousness	Low in agreeableness	High in agreeableness
Covid × Age 16–25	0.289 (0.181)	0.781*** (0.286)	0.413 (0.284)	0.586*** (0.142)	0.446* (0.266)	0.540*** (0.178)	0.438*** (0.140)	0.946 (0.650)	0.379* (0.207)	0.710*** (0.193)
Covid × Age 25–35	0.184 (0.125)	0.295*** (0.069)	0.182*** (0.062)	0.403*** (0.086)	0.253*** (0.068)	0.347*** (0.090)	0.349*** (0.064)	0.162* (0.097)	0.251*** (0.077)	0.336*** (0.075)
Covid × Age 35–45	0.262*** (0.047)	0.347*** (0.094)	0.279*** (0.055)	0.289*** (0.053)	0.225*** (0.061)	0.323*** (0.048)	0.313*** (0.058)	0.251*** (0.048)	0.262*** (0.058)	0.305*** (0.051)
Covid × Age 45–55	0.162*** (0.035)	0.396*** (0.082)	0.177*** (0.044)	0.224*** (0.041)	0.194*** (0.044)	0.207*** (0.040)	0.197*** (0.048)	0.207*** (0.037)	0.204*** (0.044)	0.199*** (0.039)
Covid × Age 55–75	0.054*** (0.018)	0.183*** (0.054)	0.094*** (0.024)	0.099*** (0.024)	0.079*** (0.026)	0.107*** (0.022)	0.085*** (0.026)	0.107*** (0.022)	0.105*** (0.023)	0.086*** (0.025)
Covid × Age 76–95	0.083** (0.034)	0.259 (0.166)	0.088** (0.043)	0.145*** (0.047)	0.118** (0.054)	0.119*** (0.040)	0.164*** (0.051)	0.083** (0.041)	0.133*** (0.042)	0.104** (0.051)
Individual FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	73,214	91,387	62,641	101,960	51,549	113,052	61,403	103,198	57,274	107,327
Individuals	10,776	24,382	9107	26,051	7680	27,478	9244	25,914	8476	26,682

Notes: Standard errors clustered at primary sample unit are in parentheses. \* $p < 0.10$ , \*\* $p < 0.05$ , \*\*\* $p < 0.01$ . The specification additionally includes age categories dummies (with age 16–25 omitted category) and region of residence dummies (12 regions in the UK with omitted category North Ireland). Outcome is standardized psychological distress. ‘Yes’ refers to individual fixed effects (FE) included.

predicting the psychological well-being outcome and the way we divide our sample in selected sub-groups. It might be the case that a combination of several traits may result in predicting the mental outcome differently. For example, extroverts and those high in agreeableness are found to be in better health (Goodwin and Engstrom, 2002). We may also expect that constructs outside of the Big-Five personality traits may have an impact on individual’s coping behaviour. We further estimate a finite mixture model that allows persons with different personality profiles to respond heterogeneously to their circumstances. Our results, available upon request, remain consistent with the trends discussed above. Again, we do find that scoring high in neuroticism, openness to experience, and extroversion appear to exacerbate the mental strain of the pandemic and subsequent lockdown measures.

One of the main results highlighted in recent studies is the gender differences in the psychological impact of COVID pandemic. The literature suggests that being a woman is a risk factor for showing worse mental health status during the pandemic (Pappa et al., 2020). Our estimates by personality traits show that the effects of pandemic on stress are different between genders especially among younger adults. Younger males with high levels of neuroticism report worsening psychological distress conditions after the first months of the pandemic. In relation to women, the effect is more pronounced for age categories 75 and over who score high in the neuroticism trait. This may be due to several reasons. As we discussed in the introduction, men and women tend to react differently to stress. The next section provides further insights on potential associations that could explain the differences in the observed psychological distress impacts.

#### 4.3. Change in individual’s daily life and financial situation

In this section we examine some potential associations that could explain the observed adverse mental health impacts. The pandemic and related containment efforts introduced a multitude of stressors to the population, in addition to fear of infection and bereavement. Changes such as ceased social interactions, loss of income (Tran et al., 2020), and lockdown measures have also been reported to have an impact on mental health (see Gasteiger et al. (2021)). Individuals who experience financial hardship face greater exposure to chronic and acute stressors (including family and relationship problems, trouble paying monthly bills, physical limitations), which results in them suffering from elevated levels of distress. Active individuals have more opportunities to engage with others, leading to positive emotional states such as self-esteem, social competence, and positive moods, which lead to lower stress levels (Feingold, 1994). In addition, emotional reactivity resulting from

stress may affect health outcomes through unhealthy behaviours such as smoking, excessive drinking, eating unhealthy foods, and drug use (Mroczek et al., 2006). We check whether these behaviours could be the possible channels through which the first months of the pandemic may influence individuals’ psychological distress outcome.

We focus on four outcomes: a) experience of financial difficulties; b) smoking; c) feeling lonely; d) becoming more physically active, measured by walking more than 30 min per day. In Figs. 2 and 3 we graph the estimates on the change in individual’s daily life and financial circumstances by which the health crisis might influence the psychological distress. The figures show the main coefficients of interest, the COVID and age interaction terms, along with 95% confidence intervals. Our empirical assessment uses similar FE models with the same set of control variables as used in models presented in Table 2.

The results show that young males and females are less likely to exercise/walk outdoors when compared to older age groups. For both young males and females, the pandemic is found to increase the feelings of loneliness, though the effect is found significant at 5% significance level for males only. Experiencing financial difficulties is more pronounced for men aged 25–35. In relation to the older adults, and women in particular, we do observe that they are more likely to exercise and less likely to experience financial difficulties.

Overall, our estimates show that worsening in psychological distress levels occurs alongside with an increase in feeling of loneliness. Our findings are in line with Barreto et al. (2020) who show that younger men living in individualistic cultures were more vulnerable to loneliness. When compared to older age group, young adults were less likely to exercise and more likely to be involved in risky health behaviours, such as smoking, which in part can explain the greater psychological distress effect we observe for adolescents. It is important to note, that we do not claim these changes in daily life routines and financial hardship are the main drivers in the association between the pandemic shock and psychological distress. The pandemic and related containment efforts introduced a multitude of stressors to population, including fear of infection, bereavement impacts, loss of social interaction and income. Due to endogeneity and reverse causality establishing such causal relation requires further consideration of the specification and exclusion restrictions. Although these variables might be taken as proxies for the quality measures of social interaction and health-related behaviours, we are aware that they measure it far from perfectly. In addition, we should be cautious in our interpretation of these results as there might be a reverse causality between stress and health-related behaviours.



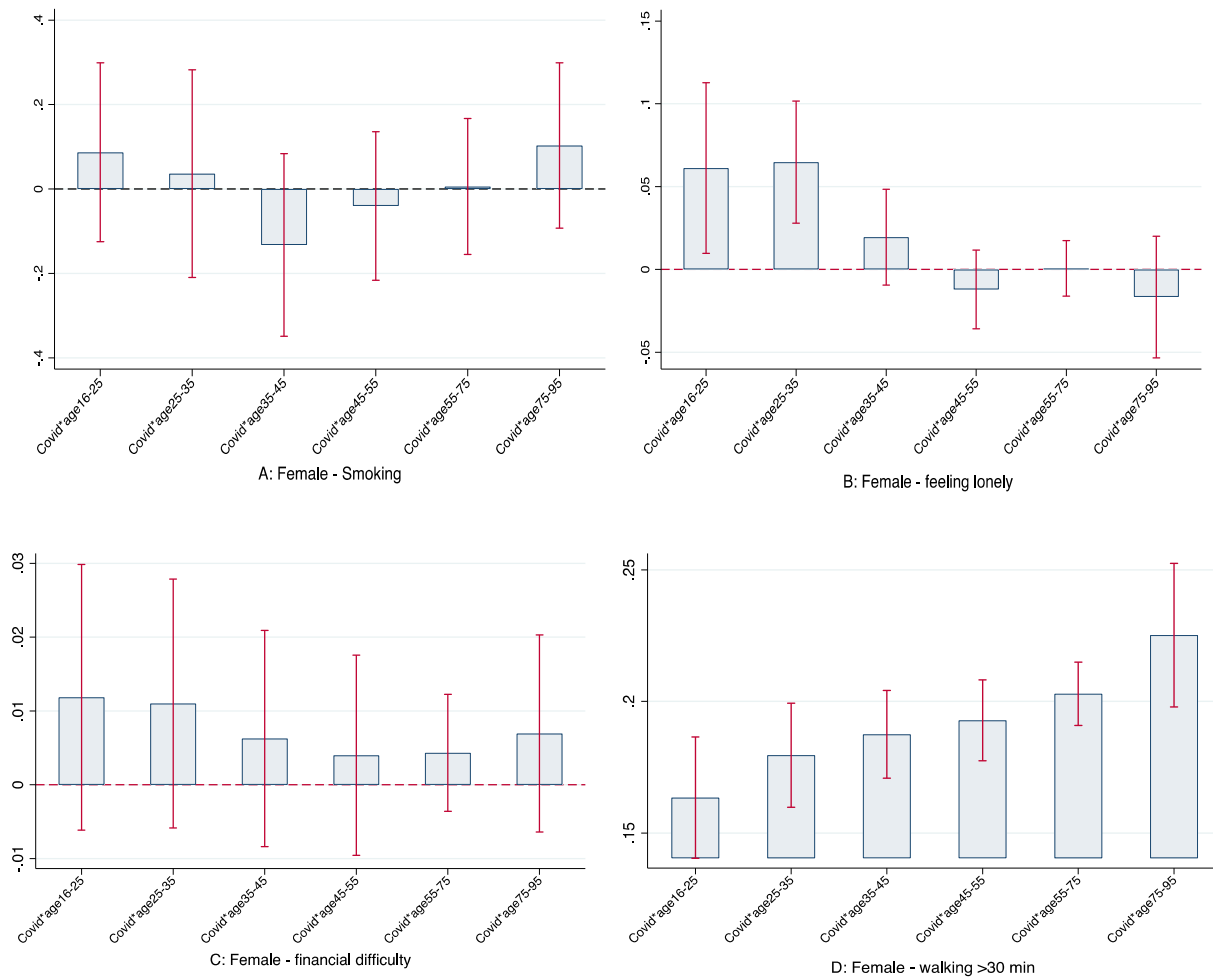


Fig. 2. COVID-19 impact on individual's daily life and financial situation – Women. Note: Figure represents the coefficients estimates from the FE models and 95% confidence intervals for the COVID age interaction terms in Eq. (1). For definitions of outcome variables see discussion in the text.

#### 4.4. Robustness analysis and attrition

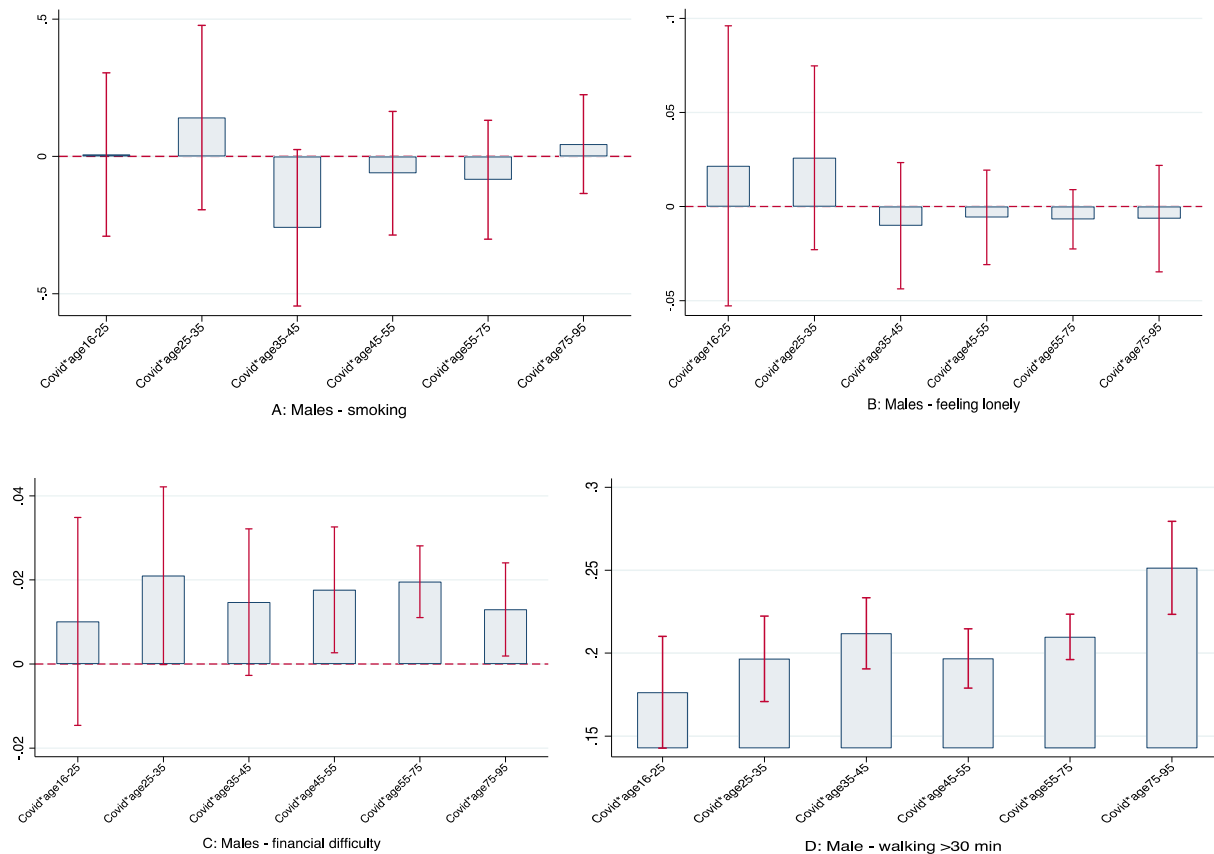
In this section we present results of the robustness analyses. We first check whether including an indicator for long-term health conditions may have an impact on psychological distress. We identify individuals who report long-standing illness or impairment and any of the following health conditions (asthma, arthritis, heart failure, coronary heart disease, angina, heart attack, stroke, hyperthyroidism, hypothyroidism, chronic bronchitis, liver condition, cancer, diabetes, epilepsy, high blood pressure). Results available upon request show that our estimates are robust to inclusion of this health indicator.

We further test whether the psychological distress effects of pandemic differ for men and women according to their household income. For this purpose, we divide our sample into four quartiles based on individual's net income and perform the FE estimates for the first (low) and fourth (high) income quartile. In online supplement Figures A1 and A2 we show the impact of the pandemic on psychological distress for individuals who are in the bottom and top quartiles of the income distribution, respectively. While we observe no significant difference in the psychological distress for women in the first – and fourth – income quartiles, for males the impact is more pronounced for those in the bottom income group.

Another potential concern is possible non-random attrition in the Understanding Society survey. Specifically, our findings might underestimate the effects of pandemic on psychological distress if the likelihood of panel attrition is higher for those showing larger psychological declines. In online supplement Table A1 we compare selective

descriptive statistics for individuals who attrit from the sample in any wave of data based on reported psychological distress and those who remain in the sample. In general, we observe that those who attrit are less likely to exercise and more likely to experience financial difficulties; the mental health index of individuals who attrit from the sample is slightly lower on average compared to those who remain in the sample. It is important to note that even if attrition was non-random, but due to fixed individual characteristics, then our FE estimator remains unbiased. We test whether attrition in psychological distress is random using the approach of Fitzgerald et al. (1998). This approach assumes that all determinants of attrition can be controlled for (selection on observables). Specifically, we implement a probit model where our dependent variable takes the value of 1 for individuals who drop out of the sample due to non-response in psychological distress, and zero for individuals who remain in the sample, conditional on variables that affect the outcome of interest along with a lag in psychological distress variable. The probit model not reported here is available upon request. The Pseudo R-squared from the attrition model suggests that baseline variables explain around 3% of psychological distress attrition between 2009 and 2020, which has a relatively low explanatory power. Variables that significantly predict attrition in psychological distress outcomes include the lag value of psychological distress, age, region of residence and long-term health indicator. A Wald test of whether these explanatory variables are jointly equal to zero suggests their joint significance in prediction the attrition.

We then use the inverse of the fitted probability to construct weights that are used to adjust our main estimates. In online supplement



**Fig. 3.** COVID-19 impact on individual's daily life and financial situation – Men. Note: Figure represents the coefficients estimates from the FE models and 95% confidence intervals for the COVID age interaction terms in Eq. (1).

Table A2 and A3 we present the weighted estimations for the standardized psychological outcome when splitting the samples by personality traits. The results show that inverse probability weighted estimates are numerically similar, and qualitatively comparable to the unweighted estimates; therefore, we acknowledge the attrition is not likely to affect our estimates. Because our weights consider important observable information, including baseline psychological distress, we conclude it is unlikely that unobservable factors driving the attrition process may substantially change our results.

As a final check we perform a multiple imputation (MI) method where we replace the missing observations in the psychological distress outcome by assuming a joint multivariate normal distribution of selected variables identified to have no missing values. We performed 10 imputation rounds. In online supplement Tables A1 and A2, we present the MI estimations for the standardized psychological outcome by personality traits. Our estimates are very similar to those reported previously in Tables 3 and 4

#### 4.5. Limitations

This study has several limitations. The present analysis adapts an approximate measure of personality as we are limited by data availability. First, we assume that personality is cross-temporally stable, which is an open question. The overall conclusion from the literature is that personality traits tend to become less volatile from childhood to adulthood. There is however a debate on whether personality traits ever become stable and eventually at which point in the lifespan of an individual this happens. For example, existing studies have demonstrated relative stability of personality from childhood to middle age (see Haan et al. (1986); Hampson and Goldberg (2006); Edmonds et al. (2013)). An additional difficulty in measuring stability in personality traits is

distinguishing between structural consistency, rank-order stability, mean-level changes, and intra-individual differences in individual change (Roberts et al., 2008). Assessing rank-order stability would be possible by tracking correlation between personality scores at different time points. Ibáñez et al. (2016) report a moderate rank-order stability among adolescents aged 12 to 15 (between 0.42 and 0.50). Authors show that some personality traits change, but overall, these changes are less marked than expected. Our sample excludes these age groups. Finally, changes in personality could be driven by major life events. We expect the effects of COVID-19 to be so profound that certain personality traits may be also affected to some extent. Therefore, we should be cautious in our interpretation of the findings for individuals aged less than 35 years old. In addition, personality traits are based on self-reported measures which may introduce some potential biases. Respondents may have implicated different perceptions about psychological construct that influence their response on the multiple items. Ideally, laboratory physiological assessments such as neurophysiological, genetic, or hormonal are preferred, however most data on personality are observational and not experimental. A large body of empirical studies, however, have utilised the Big-Five taxonomy to predict a range of economic and social outcomes (see Heckman and Rubinstein (2001); Heckman et al. (2006)).

## 5. Conclusions

Using rich longitudinal data, this article presents recent evidence on the effect of the first three months of the pandemic on individuals' psychological distress. We show that the period is associated with a significant increase in the psychological distress level of males and females, and this increase is larger for younger adults. We show that personality traits are influential moderator in this relationship,

suggesting their important role in explaining variation in individual's well-being. We found significant differential mental health impact for young adults who score relatively high in neuroticism, extroversion, and openness to experience.

Previous studies have shown that physical activity and socialisation are preventive factors for mental well-being (Gordon et al., 2008). Our findings further indicate that worsening in psychological distress levels of young adults can be partially attributed to increased feelings of loneliness and lower exercise activities among young adults. Our results indicate the necessity of programmes to assist distressed young individuals. Cognitive behaviour therapy is an effective model for working with psychologically distressed people and could be easily modified depending on individual's circumstances and personality traits. For example, mindfulness-based cognitive therapy that combines elements of cognitive-behavioural therapy (CBT) and mindful practices has been shown to be efficient in reducing the risk of relapse in recurrently depressed participants (Ma and Teasdale (2004); Teasdale et al. (2000)), as well as for reducing anxiety symptoms in generalized anxiety disorder and for individuals with high levels of neuroticism (Evans (2016); Armstrong and Rimes (2016)). Tackling personality via interventions is therefore likely to have positive externalities for promoting mental well-being during the pandemic. Finally, one possible avenue for future research is the likelihood and extent of personality change after the pandemic.

### Contribution statement

The first author was responsible for data access application, empirical model estimations and writing the main section data interpretation results. The second and third authors of the manuscript contributed to the literature search and writing article contribution and policy conclusions.

### Acknowledgement

The data was provided via the UK Data Service and is available to other researchers' subject to registration.

### Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.socscimed.2022.114884>.

### References

- Adler, N.E., Boyce, T., Chesney, M.A., Cohen, S., Folkman, S., Kahn, R.L., Syme, S.L., 1994. Socioeconomic status and health: the challenge of the gradient. *Am. Psychol.* 49 (1), 15.
- Armstrong, L., Rimes, K.A., 2016. Mindfulness-based cognitive therapy for neuroticism (stress vulnerability): a pilot randomized study. *Behav. Ther.* 47 (3), 287–298.
- Aschwanden, D., Strickhouser, J.E., Sesker, A.A., Lee, J.H., Luchetti, M., Stephan, Y., Sutin, A.R., Terracciano, A., Back, M., 2020. Psychological and behavioural responses to coronavirus disease 2019: the role of personality. *Eur. J. Pers.* 22–71–2281.
- Bakker, A.B., Van Der Zee, K.I., Lewig, K.A., Dollard, M.F., 2006. The relationship between the big five personality factors and burnout: a study among volunteer counselors. *J. Soc. Psychol.* 146 (1), 31–50.
- Banks, J., 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.
- Barreto, M., Victor, C., Hammond, C., Eccles, A., Richins, M.T., Qualter, P., 2020. Loneliness Around the World: Age, Gender, and Cultural Differences in Loneliness, p. 110066. Personality and Individual Differences.
- Brooks, S.K., Webster, R.K., Smith, L.E., Woodland, L., Wessely, S., Greenberg, N., Rubin, G.J., 2020. The psychological impact of quarantine and how to reduce it: rapid review of the evidence. *Lancet*.
- Carvalho, L.d.F., Pianowski, G., Gonçalves, A.P., 2020. Personality differences and covid-19: are extroversion and conscientiousness personality traits associated with engagement with containment measures? *Trend. Psychiatr. Psychother. (AHEAD)*.
- Connor-Smith, J.K., Flachsbart, C., 2007. Relations between personality and coping: a meta-analysis. *J. Pers. Soc. Psychol.* 93 (6), 1080.
- Costa Jr., P.T., Terracciano, A., McCrae, R.R., 2001. Gender differences in personality traits across cultures: robust and surprising findings. *J. Pers. Soc. Psychol.* 81 (2), 322.
- Cox, B., Blaxter, M., Buckle, A., Fenner, N., Golding, J., Gore, M., Huppert, F., Nickson, J., Roth, M., Stark, J., et al., 1987. The Health and Lifestyle Survey (London, Health Promotion Research Trust). CoxThe Health and Lifestyle Survey1987.
- Cuijpers, P., Smit, F., Penninx, B.W., de Graaf, R., ten Have, M., Beekman, A.T., 2010. Economic costs of neuroticism: a population-based study. *Arch. Gen. Psychiatr.* 67 (10), 1086–1093.
- Davillas, A., Benzeval, M., Kumari, M., 2016. Association of adiposity and mental health functioning across the lifespan: findings from understanding society (the UK household longitudinal study). *PLoS One* 11 (2), e0148561.
- Davillas, A., Jones, A.M., 2020. The Covid-19 Pandemic and its Impact on Inequality of Opportunity in Psychological Distress in the uk. Available at: SSRN 3614940.
- De Coninck, D., d'Haenens, L., Matthijs, K., 2020. Perceived vulnerability to disease and attitudes towards public health measures: covid-19 in flanders, Belgium. *Pers. Individ. Differ.* 166, 110220.
- Edmonds, G.W., Goldberg, L.R., Hampson, S.E., Barckley, M., 2013. Personality stability from childhood to midlife: relating teachers' assessments in elementary school to observer-and self-ratings 40 years later. *J. Res. Pers.* 47 (5), 505–513.
- Etheridge, B., Spantig, L., 2020. The Gender Gap in Mental Well-Being during the Covid-19 Outbreak: Evidence from the uk, Technical Report, ISER Working Paper Series.
- Evans, S., 2016. Mindfulness-based cognitive therapy for generalized anxiety disorder. In: *Mindfulness-based Cognitive Therapy*. Springer, pp. 145–154.
- Feingold, A., 1994. Gender differences in personality: a meta-analysis. *Psychol. Bull.* 116 (3), 429.
- Ferguson, E., 2013. Personality is of central concern to understand health: towards a theoretical model for health psychology. *Health Psychol. Rev.* 7 (Suppl. 1), S32–S70.
- Fitzgerald, J., Gottschalk, P., Moffitt, R.A., 1998. An Analysis of Sample Attrition in Panel Data: the michigan Panel Study of Income Dynamics.
- Foundation, M.H., 2020. Coronavirus: the Divergence of Mental Health Experiences during the Pandemic. Mental Health Foundation. Technical report.
- Gasteiger, N., Vedhara, K., Massey, A., Jia, R., Ayling, K., Chalder, T., Coupland, C., Broadbent, E., 2021. Depression, anxiety and stress during the Covid-19 pandemic: results from a New Zealand cohort study on mental well-being. *BMJ Open* 11 (5), e045325.
- Goodwin, R., Engstrom, G., 2002. Personality and the perception of health in the general population. *Psychol. Med.* 32 (2), 325.
- Gordon, B.A., Rykhlevskaia, E.I., Brumbach, C.R., Lee, Y., Elavsky, S., Konopack, J.F., McAuley, E., Kramer, A.F., Colcombe, S., Gratton, G., et al., 2008. Neuroanatomical correlates of aging, cardiopulmonary fitness level, and education. *Psychophysiology* 45 (5), 825–838.
- Haan, N., Millsap, R., Hartka, E., 1986. As time goes by: change and stability in personality over fifty years. *Psychol. Aging* 1 (3), 220.
- Hampson, S.E., Goldberg, L.R., 2006. A first large cohort study of personality trait stability over the 40 years between elementary school and midlife. *J. Pers. Soc. Psychol.* 91 (4), 763.
- Haushofer, J., Fehr, E., 2014. On the psychology of poverty. *Science* 344 (6186), 862–867.
- Hawkey, L.C., Cacioppo, J.T., 2010. Loneliness matters: a theoretical and empirical review of consequences and mechanisms. *Ann. Behav. Med.* 40 (2), 218–227.
- Heckman, J.J., Rubinstein, Y., 2001. The importance of noncognitive skills: lessons from the ged testing program. *Am. Econ. Rev.* 91 (2), 145–149.
- Heckman, J.J., Stixrud, J., Urzua, S., 2006. The effects of cognitive and noncognitive abilities on labor market outcomes and social behavior. *J. Labor Econ.* 24 (3), 411–482.
- Holmes, E.A., O'Connor, R.C., Perry, V.H., Tracey, I., Wessely, S., Arseneault, L., Ballard, C., Christensen, H., Silver, R.C., Everall, I., et al., 2020. Multidisciplinary research priorities for the covid-19 pandemic: a call for action for mental health science. *Lancet Psychiatr.*
- Holt-Lunstad, J., Smith, T.B., Baker, M., Harris, T., Stephenson, D., 2015. Loneliness and social isolation as risk factors for mortality: a meta-analytic review. *Perspect. Psychol. Sci.* 10 (2), 227–237.
- Ibáñez, M.I., Viruela, A.M., Mezquita, L., Moya, J., Villa, H., Camacho, L., Ortet, G., 2016. An investigation of five types of personality trait continuity: a two-wave longitudinal study of Spanish adolescents from age 12 to age 15. *Front. Psychol.* 7, 512.
- Jang, K.L., Livesley, W.J., Vemon, P.A., 1996. Heritability of the big five personality dimensions and their facets: a twin study. *J. Pers.* 64 (3), 577–592.
- Jerominus, B.F., 2015. Environmental Influences on Neuroticism: A Story about Emotional (In) Stability. University of Groningen, Groningen, The Netherlands doi 10(2.1), 3452–2407.
- Jin, X., Lian, J.-S., Hu, J.-H., Gao, J., Zheng, L., Zhang, Y.-M., Hao, S.-R., Jia, H.-Y., Cai, H., Zhang, X.-L., et al., 2020. Epidemiological, clinical and virological characteristics of 74 cases of coronavirus-infected disease 2019 (covid-19) with gastrointestinal symptoms. *Gut* 69 (6), 1002–1009.
- John, O.P., Robins, R.W., Pervin, L.A., 2010. *Handbook of Personality: Theory and Research*. Guilford Press.
- Josefsson, K., Cloninger, C.R., Hintsanen, M., Jokela, M., Pulkki-Råback, L., Keltikangas-Järvinen, L., 2011. Associations of personality profiles with various aspects of well-being: a population-based study. *J. Affect. Disord.* 133 (1–2), 265–273.
- Joseph, S., Wood, A., 2010. Assessment of positive functioning in clinical psychology: theoretical and practical issues. *Clin. Psychol. Rev.* 30 (7), 830–838.

- Komulainen, E., Meskanen, K., Lipsanen, J., Lahti, J.M., Jylhä, P., Melartin, T., Wichers, M., Isometsä, E., Ekelund, J., 2014. The effect of personality on daily life emotional processes. *PLoS One* 9 (10), e110907.
- Lazarus, R.S., 1966. *Psychological Stress and the Coping Process*. McGraw-Hill.
- Lee, E.E., Depp, C., Palmer, B.W., Glorioso, D., Daly, R., Liu, J., Tu, X.M., Kim, H.-C., Tarr, P., Yamada, Y., et al., 2019. High prevalence and adverse health effects of loneliness in community-dwelling adults across the lifespan: role of wisdom as a protective factor. *Int. Psychogeriatr.* 31 (10), 1447–1462.
- Ma, S.H., Teasdale, J.D., 2004. Mindfulness-based cognitive therapy for depression: replication and exploration of differential relapse prevention effects. *J. Consult. Clin. Psychol.* 72 (1), 31.
- Marshall, G.N., Wortman, C.B., Vickers, R.R., Kusulas, J.W., Hervig, L.K., 1994. The five-factor model of personality as a framework for personality-health research. *J. Pers. Soc. Psychol.* 67 (2), 278.
- McCrae, R.R., Costa Jr., P.T., Bossé, R., 1978. Anxiety, extraversion and smoking. *Br. J. Soc. Clin. Psychol.* 17 (3), 269–273.
- Moffitt, T.E., Arseneault, L., Belsky, D., Dickson, N., Hancox, R.J., Harrington, H., Houts, R., Poulton, R., Roberts, B.W., Ross, S., et al., 2011. A gradient of childhood self-control predicts health, wealth, and public safety. *Proc. Natl. Acad. Sci. Unit. States Am.* 108 (7), 2693–2698.
- Mroczek, D.K., Spiro, A., Griffin, P.W., Neupert, S., Schaie, K., Carstensen, L., 2006. Social Influences on Adult Personality, Self-Regulation and Health. *Social structures, Aging and self-regulation*, pp. 69–83.
- Murray, D.R., Schaller, M., 2012. Threat (s) and conformity deconstructed: perceived threat of infectious disease and its implications for conformist attitudes and behavior. *Eur. J. Soc. Psychol.* 42 (2), 180–188.
- Nordman, C.J., Sarr, L.R., Sharma, S., 2019. Skills, personality traits, and gender wage gaps: evidence from Bangladesh. *Oxf. Econ. Pap.* 71 (3), 687–708.
- Ormel, J., Jeronimus, B.F., Kotov, R., Riese, H., Bos, E.H., Hankin, B., Rosmalen, J.G., Oldehinkel, A.J., 2013. Neuroticism and common mental disorders: meaning and utility of a complex relationship. *Clin. Psychol. Rev.* 33 (5), 686–697.
- Pappa, S., Ntella, V., Giannakas, T., Giannakoulis, V.G., Papoutsis, E., Katsaounou, P., 2020. Prevalence of depression, anxiety, and insomnia among healthcare workers during the Covid-19 pandemic: a systematic review and meta-analysis. *Brain Behav. Immun.* 88, 901–907.
- Penley, J.A., Tomaka, J., 2002. Associations among the big five, emotional responses, and coping with acute stress. *Pers. Individ. Differ.* 32 (7), 1215–1228.
- Plomin, R., Deary, I.J., 2015. Genetics and intelligence differences: five special findings. *Mol. Psychiatr.* 20 (1), 98–108.
- Qian, K., Yahara, T., 2020. Mentality and behavior in covid-19 emergency status in Japan: influence of personality, morality and ideology. *PLoS One* 15 (7), e0235883.
- Roberts, B.W., Wood, D., Caspi, A., 2008. *The Development of Personality Traits in Adulthood*.
- Schaller, M., 2006. Parasites, behavioral defenses, and the social psychological mechanisms through which cultures are evoked. *Psychol. Inq.* 17 (2), 96–101.
- Schaller, M., 2015. *The Behavioral Immune System. The handbook of evolutionary psychology*, pp. 1–19.
- Sediri, S., Zgueb, Y., Ouane, S., Ouali, U., Bourgou, S., Jomli, R., Nacef, F., 2020. 'Women's Mental Health: Acute Impact of Covid-19 Pandemic on Domestic Violence'. *Archives of women's mental health*, pp. 1–8.
- Simetrica-Jacobs, 2020. *The Wellbeing Costs of Covid-19 in the uk*, Technical Report. London School of Economics and Political Science.
- Srivastava, K., Das, R., 2015. Personality and health: road to well-being. *Ind. Psychiatr. J.* 24 (1), 1.
- Steel, P., Schmidt, J., Shultz, J., 2008. Refining the relationship between personality and subjective well-being. *Psychol. Bull.* 134 (1), 138.
- Stroud, L.R., Salovey, P., Epel, E.S., 2002. Sex differences in stress responses: social rejection versus achievement stress. *Biol. Psychiatr.* 52 (4), 318–327.
- Teasdale, E., Yardley, L., Schlotz, W., Michie, S., 2012. The importance of coping appraisal in behavioural responses to pandemic flu. *Br. J. Health Psychol.* 17 (1), 44–59.
- Teasdale, J.D., Segal, Z.V., Williams, J.M.G., Ridgeway, V.A., Soulsby, J.M., Lau, M.A., 2000. Prevention of relapse/recurrence in major depression by mindfulness-based cognitive therapy. *J. Consult. Clin. Psychol.* 68 (4), 615.
- Tran, B.X., Nguyen, H.T., Le, H.T., Latkin, C.A., Pham, H.Q., Vu, L.G., Le, X.T.T., Nguyen, T.T., Pham, Q.T., Ta, N.T.K., et al., 2020. Impact of Covid-19 on economic well-being and quality of life of the Vietnamese during the national social distancing. *Front. Psychol.* 11.
- Vahia, I.V., Jeste, D.V., Reynolds, C.F., 2020. Older adults and the mental health effects of Covid-19. *JAMA* 324 (22), 2253–2254.
- Wichert, L., Pohlmeier, W., 2010. Female Labor Force Participation and the Big Five. ZEW-Centre for European Economic Research Discussion. *Paper* (10-003).
- Wijngaards, I., de Zilwa, S.C.S., Burger, M.J., 2020. Extraversion moderates the relationship between the stringency of Covid-19 protective measures and depressive symptoms. *Front. Psychol.* 11.
- Williams, T., Mayhew, M., Lagou, M., Welsby, M., 2020. *Coronavirus and Homeschooling in Great Britain: april to June 2020*. Office for National Statistics.