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Correlates of symptoms of anxiety and depression and mental wellbeing associated with COVID-19: a cross-sectional study of UK-based respondents



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ABSTRACT

Background: The aim was to assess the impact of COVID-19 self-isolation/social distancing on mental health, and potential correlates, among a sample of the UK population.

Methods: A cross-sectional study. Mental health was measured using the Beck Anxiety and Depression Inventory. Mental wellbeing was measured using The Short Warwick-Edinburgh Mental Well-being Scale. Data collected on predictors included sex, age, marital status, employment, annual income, region, current smoking, current alcohol consumption, physical multimorbidity, any physical symptoms experienced during self-isolation/social distancing, and the number of days of self-isolation/social distancing. The association between potential predictors and poor mental health was studied using a multivariable logistic regression.

Results: 932 participants were included. Factors associated with poor mental health were sex (reference: male; female: OR = 1.89, 95%CI = 1.34-2.68), age (18-24 years: reference; 45-54 years: OR = 0.27, 95%CI = 0.14-0.53; 55-64 years: OR = 0.24, 95%CI = 0.12-0.47; 65-74 years: OR = 0.10, 95% CI = 0.05-0.22; and ≥75 years: OR = 0.08, 95% CI = 0.03-0.24), annual income (<£15,000: reference; £25,000- <£40,000: OR = 0.54, 95% CI = 0.31-0.93; £40,000- <£60,000: OR = 0.39, 95% CI = 0.22-0.69; and ≥£60,000: OR = 0.38, 95% CI = 0.21-0.67), current smoking (yes: OR = 2.59, 95%CI = 1.62-4.20), and physical multimorbidity (OR = 2.35, 95%CI = 1.61-3.46).

Conclusions: In this sample of UK adults self-isolating/social distancing females, younger age groups, those with a lower annual income, current smokers and those with physical multimorbidity were associated with higher levels of poor mental health.

1. INTRODUCTION

In March 2020, the World Health Organization declared the COVID-19 outbreak a global pandemic. COVID-19 is caused by SARS-CoV-2, a variant of coronavirus. As of 6th April 2020 (10:00am CET), more than 1,244,421 cases have been diagnosed globally, with over 68,976 fatalities (GOV.UK, 2020). Symptoms of infection are usually non-specific, and include fever, cough, and myalgia, with diarrhoea, with or

without the subsequent development of dyspnea (Chan et al., 2020). Severe cases that include respiratory distress, sepsis, and septic shock have been increasingly reported with critically ill patients requiring intubation and intensive care treatments (Wang et al., 2020).

COVID-19 is a respiratory virus that is transmitted by large respiratory droplets and direct contact with infected secretions. (WHO, 2020) Therefore, on 23rd March 2020 the UK government released the following guidance for the UK public to self-isolate/social

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distance to reduce the risk of transmission. “Everyone must stay at home to help stop the spread of coronavirus. You should only leave your home for very limited purposes: 1) shopping for basic necessities, for example food and medicine, which must be as infrequent as possible 2) one form of exercise a day, for example a run, walk, or cycle – alone or with members of your household 3) any medical need, including to donate blood, avoid or escape risk of injury or harm, or to provide care or to help a vulnerable person and 4) travelling for work purposes, but only where you cannot work from home.” Prior to this the advice was that vulnerable adults should voluntarily self-isolate (i.e., not leave their home or meet anyone other than those who live in their home; NHS, 2020).

The World Health Organisation has recognised that such self-isolation/social distancing measures may result in people becoming more anxious, angry, stressed, agitated, and withdrawn (WHO, 2020). Anxiety is among the most prevalent mental health disorders (Bandelow and Michaelis, 2015) and may be defined as a persistent feeling of worry, fear or nervousness (Mental Health UK, 2020). Approximately 1 in 10 people living in the UK suffer from an anxiety-related disorder (Mental Health UK, 2020). A large body of literature shows that anxiety is associated with several detrimental consequences including lower quality of life (Brenes, 2007), suicidal ideation and attempts (Nepon et al., 2010), physical chronic conditions (including multimorbidity) (Sareen et al., 2005), relationship complications (Kasalova et al., 2017) and increased alcohol consumption (Smith and Randall, 2012). In addition to anxiety, depression is also a prevalent mental health complication (WHO, 2020). Depression causes feelings of sadness and/or a loss of interest in activities once enjoyed and for depression to be diagnosed these symptoms must last for at least two weeks (American Psychiatric Association, 2020). Similar to anxiety, depression can lead to a variety of emotional (Hawton et al., 2020) and physical (Oerlemans et al., 2007) problems and can decrease a person's ability to function at both work and at home (American Psychiatric Association, 2020). Importantly, anxiety and depression once developed tend to track across the lifespan. Owing to the known detrimental consequences of anxiety and depression it is important to ensure strategies are in place to both prevent and manage such mental health complications.

The literature suggests that a key risk factor for both anxiety and depression is perceived isolation (Santini et al., 2020). Moreover, literature shows that social network ties, social support, network structure, and participation in social activities are associated with better mental health (Cornwell and Laumann, 2015). It is thus possible that the recent restrictions placed on the UK population owing to the COVID-19 pandemic may have unintentional consequences per se on the state of mental health and mental health complications of the UK public. The consequences of the current UK public health guidance, and potential correlates of those who may be worst affected by the consequent effects of self-isolation/social distancing have not been scrutinised to date. Moreover, the fact that the UK public have not been required to follow such drastic self-isolation/social distancing guidance in modern history means that there is a limited body of literature to which one can refer to inform effective policy and practice in order to support emotional wellbeing alongside the reduction in risk of exposure to contagion.

To date just one study exists on the impact of COVID-19 on mental health. The study investigated the immediate psychological response of the COVID-19 pandemic on 1210 participants from 194 cities in China. The study found that 53.8% of respondents rated the psychological impact of the outbreak as moderate or severe, 16.5% reported moderate to severe depressive symptoms, 28.8% reported moderate to severe anxiety symptoms, and 8.1% reported moderate to severe stress levels. Female gender, student status, specific physical symptoms (e.g., myalgia, dizziness, coryza), and poor self-rated health status were significantly associated with a greater psychological impact of the outbreak and higher levels of stress, anxiety, and depression (Wang et al.,

2020).

Considering the current self-isolation/ social distancing guidance set out by the UK government and the scarcity of data on its impact on the state of mental health and mental health complications per se it is of the utmost importance to develop an understanding of the impact of such guidance on mental health and correlates of poor mental health to inform targeted intervention. The present study aimed to investigate the cross-sectional association between the UK COVID-19 self-isolation/social distancing guidance and levels of anxiety, depression and mental wellbeing, as well as potential correlates of poor mental health.

2. METHODS

2.1. Study Design and Participants

This paper presents pre-planned interim analysis of data from a cross-sectional epidemiological study, administered through an online survey. The study was launched on 17 March 2020, 17 days after the first case of COVID-19 was diagnosed in the United Kingdom. The study was approved by the Anglia Ruskin University Research Ethics Committee (16 March 2020)

Participants were recruited through social media and through national media outlets (BBC, March 26th 2020) and by distributing an invite to participate through existing researcher networks. Adults aged 18 years and over, declaring that they currently reside in the UK and were self-isolating/social distancing due to COVID-19 were eligible to participate. Participants were directed to a data encrypted website where they indicated their consent to participate after reading an information sheet.

2.2. Outcome Measures

Demographic data was collected, including sex, age (in 10-year age bands), marital status (single/separated/divorced/widowed or married/in a domestic partnership), employment, annual household income (< £15,000, £15,000- < £25,000, £25,000- < £40,000, £40,000- < £60,000, ≥ £60,000). They were also asked to indicate which of the four main UK countries they lived in (England, Northern Ireland, Scotland, Wales).

Measures of health status included whether respondents were a current smoker and consumer of alcohol (y/n), the presence of physical multimorbidity (i.e., more than three chronic diseases, this is consistent with previous research; Sakib et al., 2019). Chronic physical diseases included obesity, hypertension, myocardial infarction, angina pectoris and other coronary diseases, other cardiac diseases, varicose veins of lower extremities, osteoarthritis, chronic neck pain, chronic low back pain, chronic allergy (excluding allergic asthma), chronic bronchitis, emphysema or chronic obstructive pulmonary disease (COPD), type 1 diabetes, type 2 diabetes, diabetic retinopathy, cataract, peptic ulcer disease, urinary incontinence or urine control problems, hypercholesterolemia, chronic skin disease, chronic constipation, liver cirrhosis and other hepatic disorders, stroke, chronic migraine and other frequent chronic headaches, hemorrhoids, cancer, osteoporosis, thyroid disease, renal disease, and injury. Participants were also asked if they had experienced any physical symptoms of COVID-19 during self-isolation/social distancing (i.e., persistent cough, high temperature, sore throat, runny nose) and the number of days they had been in self-isolation/social distancing.

Mental health was measured using the Becks Anxiety Inventory (BAI) and Becks Depression Inventory (BDI). These are both 21-item questionnaires with higher BAI and BDI scores indicating more severe anxiety and depressive symptoms. The short Warwick-Edinburgh Mental Well-being Scale is a 7-item measure of mental well-being (Fat et al., 2017; Stewart-Brown et al., 2009). Poor mental health was defined as the presence of at least one of the following three criteria: moderate-to-severe anxiety symptoms (BAI score ≥ 16), moderate-to-

severe depressive symptoms (BDI score ≥ 20) (Carney et al., 2011) and poor mental wellbeing (SWEMWBS metric score ≤ 15.8) (Warwick Medical School, 2020). Mental health is a multi-component construct. Although traditional aspects of mental health have been considered in isolation, they may be experienced simultaneously. Therefore, we created a mental health score to capture a wider range of aspects of mental health in individuals than usually is examined.

2.3. Statistical Analysis

Sample characteristics were compared between individuals with and those without poor mental health using chi-squared tests for categorical variables and *t*-test for the number of days of self-isolation/social distancing. BAI, BDI and SWEMWBS scores were further compared between different sex and age groups using Analysis of Variance (ANOVA). Effect sizes were estimated using phi coefficient (chi-squared tests with binary categorical variables), Cramer's V (chi-squared tests with categorical variables with more than two categories), Cohen's *d* (*t*-tests with continuous variables), and eta squared (ANOVA with continuous variables). The association between several potential predictors (independent variables) and poor mental health (dependent variable) was studied using a multivariable logistic regression model. Potential predictors included sex, age, marital status, employment, annual income, region, current smoking, current alcohol consumption, physical multimorbidity, any physical symptom experienced during self-isolation/social distancing, and number of days of self-isolation/ social distancing. Sensitivity analyses were conducted with moderate-to-severe anxiety symptoms, moderate-to-severe depressive symptoms and poor mental wellbeing as dependent variables. Results from the logistic regression analyses are presented as odds ratios (ORs) and 95% confidence intervals (CIs). The level of statistical significance was set at $p < 0.05$. The statistical analysis was performed with R 3.5.2 (The R Foundation).

3. RESULTS

This cross-sectional study included 932 participants. 63.3% of women, and 20.8% of individuals were aged between 25 and 34 years (Table 1). The prevalence of poor mental health was 36.8% in the population. Respondents with poor mental health were significantly more likely to be women, younger and single/separated/divorced/widowed than those not reporting poor mental health, while they also had a lower annual income and were more likely to smoke and less likely to consume alcohol. Mean (SD) BAI, BDI and SWEMWBS scores were 12.1 (11.7), 11.6 (10.6) and 20.8 (5.1), respectively (Table 2). BAI and BDI scores were higher and SWEMWBS score lower in women (and in those self-identifying as non-binary, transgender or intersex individuals) and younger people than in men and older adults, respectively. Finally, the results of the multivariable regression analyses are displayed in Table 3. Factors significantly associated with poor mental health were sex (reference: male; female: OR = 1.89, 95% CI = 1.34-2.68), age (18-24 years: reference; 45-54 years: OR = 0.27, 95% CI = 0.14-0.53; 55-64 years: OR = 0.24, 95% CI = 0.12-0.47; 65-74 years: OR = 0.10, 95% CI = 0.05-0.22; and ≥ 75 years: OR = 0.08, 95% CI = 0.03-0.24), annual income (< £15,000: reference; £25,000- < £40,000: OR = 0.54, 95% CI = 0.31-0.93; £40,000- < £60,000: OR = 0.39, 95% CI = 0.22-0.69; and \geq £60,000: OR = 0.38, 95% CI = 0.21-0.67), current smoking (yes: OR = 2.59, 95% CI = 1.62-4.20), and physical multimorbidity (OR = 2.35, 95% CI = 1.61-3.46). Similar findings were obtained in the sensitivity analyses including moderate-to-severe anxiety symptoms, moderate-to-severe depressive symptoms and poor mental wellbeing as dependent variables.

4. DISCUSSION

The present study utilising a sample of 932 UK adults found that the

prevalence of poor mental health was 36.8% in individuals self-isolating/social distancing due to the COVID-19 pandemic. Correlates of poor mental health included female sex, a younger age, lower annual income, being a current smoker and having physical multimorbidity. Moreover, scores from the BAI and BDI were particularly high (i.e., demonstrating high levels of anxiety and depression) and the SWEMWBS was low (i.e., demonstrating low levels of mental wellbeing).

Findings from the present study carried out during the COVID-19 pandemic support those of the only other study carried out on mental health and mental health complications during this pandemic, to date (Wang et al., 2020). Suggesting that the COVID-19 pandemic may result in a poor mental health epidemic. However, such a claim cannot be confirmed until further longitudinal epidemiological studies emerge on this topic. Although, it should be noted that mental health complications are often not an acute phenomenon and once "developed" may reoccur throughout one's life (Bircusa et al., 2007, Scholten et al., 2013).

In the present study the prevalence of poor mental health (i.e., 36.8%) is higher than that which was reported during non-pandemic times in the UK, approximately 25% (Mind, 2020). Moreover, BAI and BDI scores in the present study are also higher than which was previously reported in populations without a psychiatric disorder (Muntingh et al., 2011; (Veerman et al., 2009). Similarly, scores for the SWEMWBS were lower (Fat et al., 2017). The higher prevalence for anxiety, depression and low mental health may be explained through two pathways. First, the pandemic itself may be increasing anxiety, depression and reducing mental wellbeing. Indeed, previous studies carried out during former pandemics have shown a heightened level of anxiety, depression, and psychological distress (Taha et al., 2014; Wheaton et al., 2012). It may be proposed that such a deterioration in mental health may result from worry about contracting the condition oneself or a loved one or friend being diagnosed with COVID-19. Moreover, the unavoidable media coverage and constant exposure to information relating to this pandemic, including an increase in cases and mortality rates, is likely to be further negatively influencing the respondents reported mental health. Second, self-isolation/social distancing is likely to negatively impact mental wellbeing and increase levels of anxiety and depression, as has been suggested in previous literature (Cornwell and Laumann, 2015; Santini et al., 2020). This impact on mental health may be a result of perceived isolation, financial concerns (owing to not working, or a reduction in custom if a business owner or self-employed), and a reduction in social interactions. In addition, the physical environment of the home space may not be conducive to a healthy experience for individuals or families living in close contact during the pandemic. Home overcrowding, inadequate facilities and poor housing standards may add to feelings of distress. Furthermore, relationships that were strained prior to the pandemic may have heightened tensions because people are forced to spend the lockdown together. Media reports confirm that worldwide reports of domestic abuse and violence have increased in frequency and severity (The New York Times, 2020). A potential increase in levels of anxiety and depression owing to government self-isolation/social distancing guidance is of concern as these behaviours have been shown to track across the lifespan and may thus present future health complications for the general public post-COVID-19 pandemic. It could therefore be purported that interventions are thus required to improve mental health during the active phase of pandemics and in order to be most efficient and to bring the most favourable outcomes, interventions should be targeted at those at greatest risk to minimise potential long-term individual health and societal health burden.

The present study showed that female sex, a younger age, lower annual income, a current smoker and those having physical multimorbidity had the lowest levels of mental health. These results are somewhat surprising as females and young people are not in the groups thought to be at higher risk of complications from COVID-19, however

Table 1
Sample characteristics (overall and by mental health status).

Characteristics	Category	Overall (N = 932)	Poor mental health		Effect size ^a	P-value ^b
			No (N = 589)	Yes (Yes = 343)		
Sex	Male	35.7	41.7	25.3	0.16	<0.001
	Female	63.3	57.5	73.5		
	Non-binary, transgender or intersex	1.0	0.9	1.2		
Age	18-24 years	10.4	7.1	16.0	0.26	<0.001
	25-34 years	20.8	16.3	28.8		
	35-44 years	16.7	16.0	18.1		
	45-54 years	17.1	18.8	13.9		
	55-64 years	16.6	18.0	14.2		
	65-74 years	13.9	18.0	6.8		
	≥75 years	4.4	5.8	2.1		
Marital status	Single/separated/divorced/widowed	44.9	39.8	53.9	0.14	<0.001
	Married/in a domestic partnership	55.1	60.2	46.1		
Employment	No	41.4	39.9	44.0	0.04	0.245
	Yes	58.6	60.1	56.0		
Annual income	<£15,000	15.0	10.7	22.5	0.19	<0.001
	£15,000- < £25,000	18.6	17.5	20.4		
	£25,000- < £40,000	22.5	22.3	22.8		
	£40,000- < £60,000	20.9	23.0	17.1		
	≥ £60,000	23.1	26.5	17.1		
Region	England	77.6	75.6	81.0	0.09	0.075
	Northern Ireland	19.0	21.5	14.8		
	Scotland	2.3	2.0	2.7		
	Wales	1.1	0.9	1.5		
Current smoking	No	87.9	92.5	79.9	0.19	<0.001
	Yes	12.1	7.5	20.1		
Current alcohol consumption	No	33.0	29.8	38.7	0.09	0.007
	Yes	67.0	70.2	61.3		
Physical multimorbidity	No	63.9	66.0	60.3	0.06	0.094
	Yes	36.1	34.0	39.7		
Any physical symptom experienced during self-isolation	No	74.0	75.2	71.8	0.04	0.310
	Yes	26.0	24.8	28.2		
Number of days of self-isolation	Mean (standard deviation)	9.1 (6.9)	9.3 (7.6)	8.8 (5.6)	0.07	0.294

Abbreviations: BAI Beck Anxiety Inventory; BDI Beck Depression Inventory; SWEMWBS Short Warwick Edinburgh Mental Wellbeing Scale.

Poor mental health was defined as the presence of at least one of the following three criteria: moderate-to-severe anxiety symptoms (BAI score ≥ 16), “moderate-to-severe depressive symptoms” (BDI score ≥ 20) and “poor mental wellbeing” (SWEMWBS metric score ≤ 15.8). These three cut-offs were selected based on previous literature. Higher BAI and BDI scores indicate more severe anxiety and depressive symptoms, respectively, while lower SWEMWBS indicates poorer mental wellbeing. Values are percentages unless otherwise stated.

^a Effect size was calculated using phi coefficient and Cramer's V for categorical variables and Cohen's d for age.

^b P-values were based on chi-squared tests except for the number of days of self-isolation (t-test).

Table 2
Mean (standard deviation) scores for anxiety symptoms, depressive symptoms and mental well-being in the overall population and by sex and age.

Population	Mean (standard deviation)	Anxiety symptoms (BAI)		Mean (standard deviation)	Depressive symptoms (BDI)		Mean (standard deviation)	Mental wellbeing (SWEMWBS)	
		Effect size ^a	P-value ^b		Effect size ^a	P-value ^b		Effect size ^a	P-value ^b
Overall	12.1 (11.7)	–	–	11.6 (10.6)	–	–	20.8 (5.1)	–	–
Sex									
Men	8.4 (9.4)	0.06	<0.001	9.9 (9.6)	0.02	<0.001	21.5 (5.2)	0.01	0.008
Women	14.1 (12.2)			12.3 (10.6)			20.6 (4.8)		
Non-binary, transgender or intersex	17.2 (20.3)			19.8 (19.0)			18.6 (6.4)		
Age									
18-24 years	17.3 (13.4)	0.07	<0.001	16.9 (11.8)	0.09	<0.001	18.9 (4.9)	0.10	<0.001
25-34 years	15.2 (12.5)			14.3 (11.5)			19.3 (5.0)		
35-44 years	12.8 (11.4)			12.8 (10.5)			20.1 (4.5)		
45-54 years	11.5 (10.8)			10.4 (9.7)			21.1 (4.5)		
55-64 years	10.4 (10.9)			10.4 (9.8)			21.6 (4.7)		
65-74 years	7.2 (9.3)			6.3 (6.3)			23.9 (4.6)		
≥75 years	6.5 (7.1)			6.7 (6.2)			22.8 (5.3)		

Abbreviations: BAI Beck Anxiety Inventory; BDI Beck Depression Inventory; SWEMWBS Short Warwick Edinburgh Mental Wellbeing Scale; ANOVA analysis of variance.

Higher BAI and BDI scores indicate more severe anxiety and depressive symptoms, respectively, while lower SWEMWBS indicates poorer mental wellbeing.

^a Effect size was calculated using eta squared.

^b P-values were based on ANOVA.

Table 3
Predictors of poor mental health, moderate-to-severe anxiety symptoms, moderate-to-severe depressive symptoms, and poor mental wellbeing in a sample of 932 adults who had undergone self-isolation during the SARS-CoV-2 pandemic in 2020 in the United Kingdom.

Characteristics	Category	Poor mental health			Moderate-to-severe anxiety symptoms			Moderate-to-severe depressive symptoms			Poor mental wellbeing		
		OR	95% CI	P-value	OR	95% CI	P-value	OR	95% CI	P-value	OR	95% CI	P-value
Sex	Male	Reference											
	Female	1.89	1.34-2.68	<0.001	2.21	1.54-3.21	<0.001	0.94	0.62-1.43	0.768	0.97	0.56-1.69	0.901
Age	Non-binary, transgender or intersex	1.25	0.27-5.45	0.760	1.18	0.22-5.16	0.835	1.67	0.35-7.83	0.507	1.51	0.20-7.63	0.642
	18-24 years	Reference											
	25-34 years	0.79	0.44-1.41	0.421	0.83	0.46-1.49	0.534	0.91	0.48-1.71	0.761	0.99	0.47-2.11	0.975
	35-44 years	0.52	0.27-1.01	0.053	0.54	0.28-1.05	0.072	0.69	0.33-1.43	0.324	0.40	0.15-1.02	0.057
	45-54 years	0.27	0.14-0.53	<0.001	0.35	0.18-0.69	0.002	0.40	0.18-0.85	0.018	0.31	0.12-0.81	0.018
	55-64 years	0.24	0.12-0.47	<0.001	0.27	0.14-0.55	<0.001	0.30	0.14-0.64	0.002	0.19	0.06-0.53	0.002
	65-74 years	0.10	0.05-0.22	<0.001	0.15	0.07-0.31	<0.001	0.06	0.02-0.15	<0.001	0.03	0.00-0.18	0.001
	≥75 years	0.08	0.03-0.24	<0.001	0.08	0.02-0.24	<0.001	0.06	0.01-0.24	<0.001	0.08	0.00-0.51	0.025
	Single/separated/divorced/widowed	Reference											
	Married/in a domestic partnership	1.14	0.79-1.65	0.477	1.10	0.76-1.60	0.619	0.73	0.47-1.12	0.148	0.57	0.32-1.02	0.059
Employment	No	Reference											
	Yes	0.77	0.51-1.14	0.191	0.77	0.51-1.15	0.201	0.55	0.34-0.86	0.009	1.05	0.57-1.96	0.870
Annual income	<£15,000	Reference											
	£15,000-£25,000	0.71	0.41-1.21	0.209	0.69	0.40-1.18	0.175	0.69	0.37-1.27	0.233	0.46	0.21-0.97	0.046
	£25,000-£40,000	0.54	0.31-0.93	0.026	0.57	0.33-0.99	0.047	0.86	0.47-1.59	0.636	0.47	0.21-1.02	0.057
	£40,000-£60,000	0.39	0.22-0.69	0.001	0.40	0.22-0.72	0.002	0.51	0.26-0.98	0.046	0.36	0.15-0.82	0.017
	≥£60,000	0.38	0.21-0.67	0.001	0.37	0.20-0.67	0.001	0.59	0.30-1.17	0.132	0.42	0.17-1.00	0.053
Region	England	Reference											
	Northern Ireland	0.74	0.48-1.12	0.156	0.82	0.53-1.26	0.375	0.81	0.48-1.34	0.424	1.29	0.65-2.43	0.443
	Scotland	1.00	0.36-2.64	0.998	0.80	0.27-2.17	0.677	1.50	0.47-4.26	0.465	1.70	0.36-5.82	0.440
Current smoking	Wales	1.56	0.37-6.36	0.531	1.85	0.45-7.50	0.380	0.38	0.02-2.67	0.403	NA		
	No	Reference											
Current alcohol consumption	Yes	2.59	1.62-4.20	<0.001	2.46	1.54-3.95	<0.001	2.39	1.45-3.90	<0.001	1.77	0.94-3.22	0.070
	No	Reference											
Physical multimorbidity	Yes	0.87	0.62-1.22	0.420	1.00	0.71-1.42	0.985	0.67	0.45-1.00	0.050	0.70	0.42-1.18	0.174
	No	Reference											
Any physical symptom experienced during self-isolation	Yes	2.35	1.61-3.46	<0.001	2.23	1.52-3.30	<0.001	2.16	1.37-3.44	0.001	2.26	1.23-4.19	0.009
	No	Reference											
Number of days of self-isolation	Yes	1.13	0.78-1.62	0.510	1.14	0.79-1.65	0.486	0.82	0.52-1.26	0.370	1.46	0.84-2.50	0.173
	Per one-day increase	1.00	0.97-1.02	0.751	1.00	0.97-1.02	0.927	0.96	0.91-0.99	0.038	0.97	0.91-1.02	0.224

Abbreviations: SARS-CoV-2 severe acute respiratory syndrome coronavirus 2; OR odds ratio; CI confidence interval; BAI Beck Anxiety Inventory; BDI Beck Depression Inventory; SWEMWBS Short Warwick Edinburgh Mental Wellbeing Scale.
 Poor mental health was defined as the presence of at least one of the following three criteria: “moderate-to-severe anxiety symptoms” (BAI score ≥16), “moderate-to-severe depressive symptoms” (BDI score ≥20) and “poor mental wellbeing” (SWEMWBS metric score ≤15.8). These three cut-offs were selected based on previous literature. Higher BAI and BDI scores indicate more severe anxiety and depressive symptoms, respectively, while lower SWEMWBS indicates poorer mental wellbeing.
 Logistic regression models included the following independent variables: sex, age, marital status, employment, annual income, region, current smoking, current alcohol consumption, physical multimorbidity, any physical symptom experienced during self-isolation, and the number of days of self-isolation.

these correlates have also been observed to be associated with poor mental health during non-pandemic times (Lorant et al., 2007; Mental Health, 2020; Patel et al., 2007; Stickley and Koyanagi, 2018; Stubbs et al., 2018).

Interestingly, the results also do not conform to usual U-shape relationship between age and mental wellbeing. Typically, young and older people report higher levels of mental wellbeing (Blanchflower and Oswald, 2008), with middle aged adults reporting the lowest levels. The U-shaped relationship may result from the quelling of the aspirations of youth as people enter middle age, and subsequently adjusted downwards in later life (Blanchflower and Oswald, 2008). The apparent linear relationship between age and mental wellbeing suggests that the current pandemic may be disproportionately affecting young people. Further research is required to understand why this might be, including if it is due to declining economic prospects or diminished social contacts. Once these mechanisms have been identified targeted interventions may be implemented. However, several interventions to improve mental health status in young adults have been established utilising an internet-based delivery, overcoming a key barrier during COVID-19 self-isolation/social distancing (Ye et al., 2014). Additional research should also consider the impact of self-isolation/social distancing on specific marginalised and at risk populations (e.g., LGBT+ youth). Interventions to improve mental health during the COVID-19 pandemic should apparently focus specifically on those groups.

Findings from the present study must be interpreted in light of its limitations. First, those suffering from poor mental health may have been more likely to complete the present survey and thus potentially introduce self-selection bias into the findings. Next, participants were asked to self-report on their mental and physical health, potentially introducing reporting bias. Third, analyses were cross-sectional and thus it is not possible to determine trajectories of mental health during the current pandemic. Future research using multiple time points is thus warranted. Fourth, the present study collected data on a sample of the UK public utilising an online questionnaire. Further research is required using other samples of UK adults to confirm or refute the present findings. Finally, those with psychiatric disorders may have higher levels of anxiety than the general public. However, such data was not reported and thus it is possible that some participants included in this study may have had a psychiatric disorder.

In conclusion, in the present sample of 932 UK adults who completed the survey while under UK government self-isolation/social distancing instructions during the COVID-19 pandemic, high levels of the symptoms of anxiety and depression and low levels of mental health were reported. Correlates of these mirror those during non-pandemic times. Among UK adults self-isolating/social distancing females, younger age groups, those with a lower annual income, current smokers and those with physical multimorbidity were associated with higher levels of poor mental health. Interventions to improve mental health during the COVID-19 pandemic should focus on these groups. Moreover, future research is now required to understand why the COVID-19 pandemic may be disproportionately influencing the mental health status of these populations.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.psychres.2020.113138.

References

- American Psychiatric Association. What Is Depression? <https://www.psychiatry.org/patients-families/depression/what-is-depression> (accessed 15 April 2020).
- Bandelow, B., Michaelis, S., 2015. Epidemiology of anxiety disorders in the 21st century. *Dialogues Clin Neurosci* 17 (3), 327–335.
- Blanchflower, D.G., Oswald, A.J., 2008. Is well-being U-shaped over the life cycle? *Soc Sci Med* 66 (8), 1733–1749. <https://doi.org/10.1016/j.socscimed.2008.01.030>.
- Brenes, G.A., 2007. Anxiety, depression, and quality of life in primary care patients. *Prim Care Companion J Clin Psychiatry* 9 (6), 437–443. <https://doi.org/10.4088/pc.v09n0606>.
- Burcusa, S., Lacono, W., 2007. Risk for recurrence in depression. *Clinical Psychological Review* 27 (8), 959–985. <https://doi.org/10.1016/j.cpr.2007.02.005>.
- Carney, C.E., Moss, T.G., Harris, A.L., et al., 2011. Should we be anxious when assessing anxiety using the Beck Anxiety Inventory in clinical insomnia patients? *J. Psychiatr. Res.* 45 (9), 1243–1249. <https://doi.org/10.1016/j.jpsychires.2011.03.011>.
- Chan, J.F.W., Yuan, S., Kok, K.H., et al., 2020. A familial cluster of pneumonia associated with the 2019 novel coronavirus indicating person-to-person transmission: a study of a family cluster. *The Lancet* 395 (10223), 514–523. [https://doi.org/10.1016/s0140-6736\(20\)30154-9](https://doi.org/10.1016/s0140-6736(20)30154-9).
- Cornwell, B., Laumann, E.O., 2015. The health benefits of network growth: New evidence from a national survey of older adults. *Soc. Sci. Med.* 125, 94–106. <https://doi.org/10.1016/j.socscimed.2013.09.011>.
- Fat, L.N., Scholes, S., Boniface, S., et al., 2017. Evaluating and establishing national norms for mental wellbeing using the short Warwick-Edinburgh mental well-being scale (SWEMWBS): findings from the health survey for England. *Qual Life Res* 26 (5), 1129–1144. <https://doi.org/10.1007/s11136-016-1454-8>.
- GOV.UK. Coronavirus (COVID-19): what you need to do. <https://www.gov.uk/government/publications/wuhan-novel-coronavirus-background-information/wuhan-novel-coronavirus-epidemiology-virology-and-clinical-features> (accessed 15 April 2020).
- Kasalova, P., Prasko, J., Holubová, M., et al., 2017. Anxiety disorders and marital satisfaction. *Neuro Endocrinol. Lett.* 38 (8), 555–564.
- Lorant, V., Croux, C., Weich, S., et al., 2007. Depression and socio-economic risk factors: 7-year longitudinal population study. *Brit J Psychiatr* 190 (4), 293–298. <https://doi.org/10.1192/bjp.bp.105.020040>.
- Mental Health UK. What is anxiety? <https://mentalhealth-uk.org/help-and-information/conditions/anxiety-disorders/what-is-anxiety/> (accessed 15 April 2020).
- MIND.ORG.UK. Mental health facts and statistics. <https://www.mind.org.uk/information-support/types-of-mental-health-problems/statistics-and-facts-about-mental-health/how-common-are-mental-health-problems/> (accessed 15 April 2020).
- Muntingh, A.D., van der Feltz-Cornelis, C.M., van Marwijk, H.W., et al., 2011. Is the beck anxiety inventory a good tool to assess the severity of anxiety? A primary care study in The Netherlands study of depression and anxiety (NESDA). *BMC Fam Pract* 12 (1), 66. <https://doi.org/10.1186/1471-2296-12-66>.
- Nepon, J., Belik, S.L., Bolton, J., et al., 2010. The relationship between anxiety disorders and suicide attempts: findings from the National Epidemiologic Survey on Alcohol and Related Conditions. *Depress Anxiety* 27 (9), 791–798. <https://doi.org/10.1002/da.20674>.
- NHS.UK. Advice for everyone - Coronavirus (COVID-19). <https://www.nhs.uk/conditions/coronavirus-covid-19/> (accessed 15 April 2020).
- Oerlemans, M.E., van den Akker, M., Schuurman, A.G., et al., 2007. A meta-analysis on depression and subsequent cancer risk. *Clin Pract Epidemiol Ment Health* 3 (1), 29. <https://doi.org/10.1186/1745-0179-3-29>.
- Patel, V., Flisher, A.J., Hetrick, S., et al., 2007. Mental health of young people: a global

- public-health challenge. *The Lancet* 369 (9569), 1302–1313. [https://doi.org/10.1016/s0140-6736\(07\)60368-7](https://doi.org/10.1016/s0140-6736(07)60368-7).
- Sakib, M., Shoostari, S., St.John, P., et al., 2019. The prevalence of multimorbidity and associations with lifestyle factors among middle-aged Canadians: an analysis of Canadian Longitudinal Study on Aging data. *BMC Public Health* 19 (243). <https://doi.org/10.1186/s12889-019-6567-x>.
- Santini, Z.I., Jose, P.E., Cornwell, E.Y., et al., 2020. Social disconnectedness, perceived isolation, and symptoms of depression and anxiety among older Americans (NSHAP): a longitudinal mediation analysis. *Lancet Public Health* 5 (1), e62–e70. [https://doi.org/10.1016/s2468-2667\(19\)30230-0](https://doi.org/10.1016/s2468-2667(19)30230-0).
- Sareen, J., Cox, B.J., Clara, I., et al., 2005. The relationship between anxiety disorders and physical disorders in the US National Comorbidity Survey. *Depress Anxiety* 21 (4), 193–202. <https://doi.org/10.1002/da.20072>.
- Scholten, W., Batelaan, N., Balkon, A., et al., 2013. Recurrence of anxiety disorders and its predictors. *Journal Affective Disorders* 147 (1-3), 180–185. <https://doi.org/10.1016/j.jad.2012.10.031>.
- Smith, J.P., Randall, C.L., 2012. Anxiety and alcohol use disorders: comorbidity and treatment considerations. *Alcohol Res* 34 (4), 414–431.
- Stewart-Brown, S., Tennant, A., Tennant, R., et al., 2009. Internal construct validity of the Warwick-Edinburgh mental well-being scale (WEMWBS): a Rasch analysis using data from the Scottish health education population survey. *Health Qual Life Outcomes* 7, 15. <https://doi.org/10.1186/1477-7525-7-15>.
- Stickley, A., Koyanagi, A., 2018. Physical multimorbidity and loneliness: A population-based study. *PloS one* 13 (1), e0191651. <https://doi.org/10.1371/journal.pone.0191651>.
- Stubbs, B., Vancampfort, D., Firth, J., et al., 2018. Association between depression and smoking: a global perspective from 48 low-and middle-income countries. *J. Psychiatr. Res.* 103, 142–149. <https://doi.org/10.1016/j.jpsychires.2018.05.018>.
- Taha, S., Matheson, K., Cronin, T., et al., 2014. Intolerance of uncertainty, appraisals, coping, and anxiety: The case of the 2009 H1N1 pandemic. *Br. J. Health Psychol.* 19 (3), 592–605. <https://doi.org/10.1111/bjhp.12058>.
- The New York Times. A New Covid-19 Crisis: Domestic Abuse Rises Worldwide. <https://www.nytimes.com/2020/04/06/world/coronavirus-domestic-violence.html> (accessed 15 April2020).
- Veerman, J.L., Dowrick, C., Ayuso-Mateos, J.L., et al., 2009. Population prevalence of depression and mean Beck Depression Inventory score. *Brit J Psychiat* 195 (6), 516–519.
- Wang, C., Horby, P.W., Hayden, F.G., et al., 2020. A novel coronavirus outbreak of global health concern. *The Lancet* 395 (10223), 470–473. [https://doi.org/10.1016/s0140-6736\(20\)30185-9](https://doi.org/10.1016/s0140-6736(20)30185-9).
- Warwick Medical School. Collect, score, analyse and interpret WEMWBS. <https://warwick.ac.uk/fac/sci/med/research/platform/wemwbs/using/howto/> (accessed 15 April2020).
- Wheaton, M.G., Abramowitz, J.S., Berman, N.C., et al., 2012. Psychological predictors of anxiety in response to the H1N1 (swine flu) pandemic. *Cognit Ther Res* 36 (3), 210–218. <https://doi.org/10.1007/s10608-011-9353-3>.
- World Health Organization. Depression. <https://www.who.int/news-room/fact-sheets/detail/depression> (accessed 15 April2020).
- Ye, X., Bapuji, S., Winters, S., et al., 2014. Effectiveness of internet-based interventions for children, youth, and young adults with anxiety and/or depression: a systematic review and meta-analysis. *BMC Health Service Research* 14 (313). <https://doi.org/10.1186/1472-6963-14-313>.