Title

Anxiety, Depression, Traumatic Stress, and COVID-19 Related Anxiety in the UK General Population During the COVID-19 Pandemic.

Running Head

UK POPULATION MENTAL HEALTH AND COVID-19

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Abstract

Background

The COVID-19 pandemic has created an unprecedented global crisis necessitating drastic changes to living conditions, social-life, personal freedom and economic activity. No study has yet examined the presence of psychiatric symptoms in the UK population in similar conditions.

Aims

We investigated the prevalence of COVID-19 related anxiety, generalised anxiety, depression and trauma symptoms in the UK population during an early phase of the pandemic, and estimated associations with variables likely to influence these symptoms.

Method

Between 23rd and 28th March 2020, a quota sample of 2025 UK adults 18 years and older, stratified by age, sex and household income, was recruited by online survey company Qualtrics. Participants completed standardised measures of depression, generalised anxiety, and trauma symptoms relating to the pandemic. Bivariate and multivariate associations were calculated for demographic and health related variables.

Results

Higher levels of anxiety, depression and trauma symptoms were reported compared to previous population studies, but not dramatically so. Anxiety or depression, and trauma symptoms were predicted by young age, presence of children in the home, and high estimates of personal risk. Anxiety and depression were also predicted by low income, loss of income, and pre-existing health conditions in self and other. Specific anxiety about COVID-19 was greater in older participants.

Conclusions

This study showed a modest increase in the prevalence of mental health problems in the early stages of the pandemic and these were predicted by several specific COVID-related variables. Further similar surveys, particularly of those with children at home, are required as the pandemic progresses.

KEY WORDS: COVID-19 pandemic, Anxiety, Depression, Traumatic Stress, UK general population survey

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Availability of data and materials: The datasets generated during and/or analysed during the current study will be archived with the UK Data Service (https://ukdataservice.ac.uk/) within six months of the study ending.

Anxiety, Depression, and Posttraumatic Stress in the UK General Population During the 2020 COVID-19 Pandemic.

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) was first detected in Wuhan, China on 31 December 2019. The disease it causes has been named COVID-19. The first UK coronavirus case was confirmed on 31st January 2020, and on the 11th March 2020 the World Health Organisation declared the global spread of COVID-19 as a pandemic. Since then there have been rapidly increasing cases and deaths associated with the virus globally and in the UK. On the evening of 23rd March 2020 the UK Prime Minister announced extensive restrictions on freedom of movement, the closure of non-essential businesses, and the requirement to stay at home except for limited purposes. The mental health consequences for the population of an existential threat on the scale of the current pandemic, and of the associated restrictions on movement and social gatherings, are not well understood.

There has been research on the psychological impact of other infectious respiratory diseases (IRD) such as SARS, the H1N1 flu pandemic and MERS. However, with a few exceptions, mostly from the Far East and which have focused largely on anxiety and its impact on risk perception and health behaviours rather than mental health more broadly [1] [2], these studies have predominantly considered health care workers [3] [4] and patients [5]. This absence of knowledge is troubling because there is plausible evidence from modelling that emotional and behavioural responses to a pandemic may affect its course [6] and because the burden of population mental ill-health may have implications for resources during the pandemic and national recovery afterwards. In 2003, the Canadian National Advisory Committee on SARS and Public Health[7], proposed that a 'systemic perspective', which focused not only on medical staff and patients but also the general population, should be prioritised by all those engaged in IRD psychosocial

research. A similar approach was advocated in a recent UK expert panel convened by the Academy of Medical Sciences and the mental health research charity MQ. [8]

Here we report initial findings from the first wave of a longitudinal, multi-wave survey of the social and psychological impacts of COVID-19 on the UK population conducted by researchers in seven UK and Irish universities (the Covid-19 Psychological Research Consortium; C19PRC) [9]. Of note, in a mirror study with similar methodology, we recently reported the social and psychological impacts of COVID-19 on the Republic of Ireland population[10]. The primary aim of this paper is to assess the levels of anxiety, depression and traumatic stress, based on validated self-report measures, in a large, representative community sample during an early stage of the pandemic, between March 23rd and March 28th, 2020. Based on scant previous studies [11] [2] and given the dramatic restrictions imposed because of COVID-19, we expected higher levels of common psychological and stress symptoms compared with previous population estimates. Our secondary aim was to identify groups that are psychologically vulnerable during the pandemic, by assessing the relationship between levels of anxiety, depression and traumatic stress and (1) age; (2) household income; (3) economic threat due to COVID-19; (4) health related risk factors (being male, self or close friend/relative having pre-existing serious health condition), (5) COVID-19 infection status, (6) anxiety specifically related to COVID-19, (7) perceived risk of COVID-19 infection, (8) living in an urban area, (9) living as a lone adult and (10) living with children in the home.

Methods

Recruitment and Participants

Data collection started on 23rd March 2020, 52 days after the first confirmed COVID-19 case in the UK and on the same day at 8.30pm that the UK Prime Minister announced the 'lockdown'

that required all people in the UK to stay at home except for very limited purposes, and was completed on 28th March 2020. The fieldwork was conducted by the survey company Qualtrics. The UK adult population aged 18 years and older was the target population and quota sampling methods were used to ensure the sample was representative of this population in terms of age and sex, based on 2016 population estimates from Eurostat, and household income based on the 2017 Office for National Statistics household income bands. Qualtrics provides the online platform to securely house data and leverages partners to connect with potential participants who could have been alerted to the study in one of two ways: (1) they opted to enter studies they were eligible for themselves by signing up to a panel platform; or (2) they received automatic notification through a partner router which alerted them to studies for which they were eligible (either via email, SMS, in-app notifications). Importantly, to avoid self-selection bias, survey invitations to eligible participants only provide general information and do not include specific details about the contents of the survey. Participants were required to be an adult (18+ years or older), able to read and write in English, and a resident of the UK. No other exclusion criteria were applied. Panel members were not obliged to take part in the study.

For the purposes of quota sampling to age, sex and household income Qualtrics proceeded as follows during the six days of fieldwork: (1) respondents in 'hard to reach' quota groups (e.g. young adults in the highest income bands) were prioritised and targeted first; (2) next, the focus shifted to allow the quotas to 'fill up' naturally, without specific targeting; and (3) finally, a switch back to targeting respondents to fill incomplete quotas ensued. Participants followed a link to a secure website and completed all surveys online. The invite link was active for a participant until a quota they would have qualified for was reached but after the quota was filled, previously eligible respondents were prevented from taking part in this study. Participants were informed about the purpose of the study, that their data would be treated in confidence, that

geolocation would be used to determine the area in which they lived, and of the right to terminate the study at any time without giving a reason. All participants provided informed consent prior to completing the survey and were directed to contact the NHS 111 COVID-19 helpline at the end of the survey if they experienced any distress or had additional concerns about COVID-19. Ethical approval for the study was granted by the ethical review board of Sheffield University.

Qualtrics employed checks to identify and remove any participants who completed the survey in less than the minimum completion time to ensure responses were trustworthy (half the median time of the 'soft-launch' with 50 participants) or potential duplicate respondents. The pre-recruitment quotas were achieved with a high level of accuracy; the quotas were obtained to within 1% for sex, 0.1%-0.6% for the age bands, and 0.25%-1% for the household income bands. The 2014 Adult Psychiatric Morbidity Survey in England estimated the rate of posttraumatic stress disorder to be 4.4%[11]; this was lower than rates for anxiety and depression. To detect a disorder with a prevalence of 4%, with precision of 1%, and 95% confidence level, a sample size of 1476 was required. However, estimating the prevalence of disorders with a low prevalence (< 5%) may result in a small number of 'cases' being identified. For instance, a sample size of 1476 and prevalence of 4% will identify approximately 60 cases, and if follow-up analyses are based only on these cases, then tests may be underpowered. To detect a correlation of .30, with alpha = .05, and power of .80, 84 cases is required (or an overall sample size of 2100). As a compromise between ensuring adequate sampling to reliably estimate prevalence and adequate power for sub-group analysis, a target sample size of 2000 participants was set.

Given the dual processes used by Qualtrics and partners to recruit respondents to quotas, it is not possible to determine the number of survey invites that were distributed to panel members, or indeed the number of panellists who were alerted to the survey and who did/did not complete the

survey (i.e. a response rate). Qualtrics did provide some metrics for the study, as follows: (1) 159 respondents did not provide full informed consent and were screened out; 35 respondents who completed the survey from outside the UK or were aged under 18 years were also screened out; to ensure responses were trustworthy 77 participants who completed the survey in less than the minimum completion time were removed, as were 64 potential duplicate respondents. This resulted in a sample of 2025 participants who completed the survey over six days of fieldwork. Subsequent checks ensured that they were also representative of the population in voting history, number of people in household and other important demographic characteristics [9].

Participants were recruited from the four countries of the UK proportional to their relative population size: England (86.9%), Wales (3.1%), Scotland (7.8%), Northern Ireland (2.3%). The mean age of the sample was 45.44 years (*Mdn* = 45.00, *SD* = 15.90, range 18-83), and 51.7% (*n* = 1047) were female, 48.0% male (*n*=972) and .3% (*n*=6) checked the transgender/prefer not to say/other option. Most reported that they were born in the UK (90.6%, n=1834) and grew up (spent most of their life up to 16 years) in the UK (92.4%, n=1872). Participants reported their ethnicity: White British/Irish (n=1732, 85.5%), White non-British/Irish (n=116, 5.7%), Indian (n=41, 2.0%), Pakistani (n=27, 1.3%), Chinese (n=19, .9%), other Asian/ Afro-Caribbean/ African/ Arab/ Bangladeshi/ Other (n=90, 4.30%). Regarding highest level of educational achievement, 19.0% (*n* = 385) had completed O-Level/ GCSE or similar, 18.1% (*n* = 366) had completed A-Level or similar, 28.2% (*n* = 572) had completed an undergraduate degree and 15.6% (*n* = 316) had completed a postgraduate degree, with 19.1% (n=386) reporting No Qualifications, Diploma, Other qualifications or Technical qualification. Nearly half of the respondents were in full-time employment (48.8%, *n* = 988), 15.0% (*n* = 303) were in part-time employment, 16.5% (*n* = 334) were retired, 4.7% (n=95) were students, and

5.1% (n = 103) were currently unemployed and seeking work, 3.4% (n=69) were not working due to disability, and 6.6% (n=133) were unemployed and not seeking work.

Measures

Demographic: Self-reported gender and age were recorded, and age was also categorised into a 6-level variable for the regression analysis.

Living Area: Participants were asked "Do you consider yourself to live in:" and were required to choose one of the options provided: 'City', 'Suburb', 'Town', or 'Rural'.

Lone adult: Participants were asked "How many adults (18 years or above) live in your household (including yourself)?" and were provided with options ranging from '1' to '10 or more'. The data were recoded into a binary variable to represent living alone.

Children: participants were asked "How many children (below the age of 18) live in your household?" and were provided with options ranging from '1' to '10 or more'. The scores were categorised into 4 groups (0, 1, 2, 3 or more children).

Income: Participants were asked "Please choose from the following options to indicate your approximate gross (before tax is taken away) household income in 2019 (last year). Include income from partners and other family members living with you and all kinds of earnings including salaries and benefits" to choose one of 5 categories: "£0 - £300 per week (equals about £0 - £1290 per month or £0 - 15,490 per year)", "£301 - £490 per week (equals about £1,291 - £2,110 per month or £15,491 - £25,340 per year)", "£491 - £740 per week (equals about £2,111 - £3,230 per month or £25,341 - £38,740 per year)", "£741 - £1,111 per week (equals about £3,231 - £4,830 per month or £38,741 - £57,930 per year)", and "£1,112 or more per week (equals about £4,831 or more per month or £57,931 or more per year)".

Loss of income: Participants were asked "Some people have lost income because of the coronavirus COVID-19 pandemic, for example because they have not been able to work as much or because business contracts have been cancelled or delayed. Please indicate whether your household has been affected in this way" and the response options were "My household has lost income because of the coronavirus COVID-19 pandemic", "My household has not lost income because of the coronavirus COVID-19 pandemic", "I do not know whether my household has lost income because of the coronavirus COVID-19 pandemic". The first option was considered as 'Yes' (1) and the other options were collapsed to represent 'No'.

Heath problems: Participants were asked "Do you have diabetes, lung disease, or heart disease?" and the response options were 'Yes' (1) and 'No' (0). They were also asked "Do any of your immediate family have diabetes, lung disease, or heart disease?" and the response options were 'Yes' (1) and 'No' (0).

Covid-19 status, self and other: Participants were asked "Have you been infected by the coronavirus COVID-19?" and six responses were provided. These were collapsed into a binary variable representing 'Perceived infection status'. Positive perceived infection status was based on the selection of either, 'I have the symptoms of the COVID-19 virus and think I may have been infected' or 'I have been infected by the COVID-19 virus and this has been confirmed by a test'. Negative perceived infection status was based on the selection of either, 'No. I have been tested for COVID-19 and the test was negative', 'No, I do not have any symptoms of COVID-19', 'I have a few symptoms of cold or flu but I do not think I am infected with the COVID-19 virus' or 'I may have previously been infected by COVID-19 but this was not confirmed by a test and I have since recovered'. Positive status (self) was coded '1' and negative status coded as '0'.

Participants were also asked "Has someone close to you (a family member or friend) been infected by the coronavirus COVID-19?" and four responses were provided. These were

collapsed into a binary variable representing 'Perceived infection status – someone close'. Positive perceived infection status was based on the selection of either, 'Someone close to me has symptoms, and I suspect that person has been infected' or 'Someone who is close to me has had a COVID-19 virus infection confirmed by a doctor'. Negative perceived infection status was based on the selection of either, 'No' or 'Someone close to me has symptoms, but I am not sure if that person is infected'. Positive status (other) was coded '1' and negative status coded as '0'.

Perceived risk of COVID-19 infection: Participants were asked "What do you think is your personal percentage risk of being infected with the COVID-19 virus over the following time periods?", and three sliders were presented, one for each time period; (1) In the next month, (2) In the next three months, (3) In the next six months? The slider had '0' and '100' at the left and right hand extremes respectively, showed 10 point increments, and the labels 'No Risk', 'Moderate Risk' and 'Great Risk' were shown on the left, middle and right-hand part of the scale respectively. These produced continuous scores, for each time period, ranging from 0 to 100 with higher scores reflecting higher levels of perceived risk of being infected by COVID-19. The scores were recoded into 'Low' (0 - 33), 'Moderate' (34 - 67), and 'High' (68 - 100).

Depression: Nine symptoms of depression were measured using the *Patient Health Questionnaire-9* (PHQ-9).[13] Participants indicate how often they have been bothered by each symptom over the last two weeks using a four-point Likert scale ranging from 0 (*Not at all*) to 3 (*Nearly every day*). Possible scores range from 0 to 27, with higher scores indicative of higher levels of depression. To identify participants likely to meet the criteria for depressive disorder a cut-off score of 10 was used. This cut-off produces adequate sensitivity (.85) and specificity (.89), corresponds to 'moderate' levels of depression [14], and is used to identify a level of depression that may require psychological intervention [15]. The psychometric properties of the

PHQ-9 scores have been widely supported, and the reliability of the scale among the current sample was excellent (α = .92).

Generalized Anxiety: Symptoms of generalized anxiety were measured using the *Generalized Anxiety Disorder 7-item Scale* (GAD-7) [16]. Participants indicate how often they have been bothered by each symptom over the last two weeks on a four-point Likert scale (0 = *Not at all*, to 3 = *Nearly every day*). Possible scores range from 0 to 21, with higher scores indicative of higher levels of anxiety. A cut-off score of 10 was used, and this has been shown to result in sensitivity of 89% and a specificity of 82%[16]. The GAD-7 has been shown to produce reliable and valid scores in community studies [16] and the reliability in the current sample was high (α = .94).

Traumatic Stress: The International Trauma Questionnaire [18] is a self-report measure of ICD-11 PTSD based on a total of six symptoms across the three symptom clusters of Re-experiencing, Avoidance, and Sense of Threat; each symptom cluster is comprised of 2 symptoms. Participants were asked to complete the ITQ "…in relation to your experience of the COVID-19 pandemic. Please read each item carefully, then select one of the answers to indicate how much you have been bothered by that problem in the past month". The PTSD symptoms are accompanied by three items measuring functional impairment caused by these symptoms. All items are answered on a five-point Likert scale, ranging from 0 (*Not at all*) to 4 (*Extremely*) with possible scores ranging from 0 to 24. A score of ≥ 2 (*Moderately*) is considered 'endorsement' of that symptom. A PTSD diagnosis requires traumatic exposure, and at least one symptom to be endorsed from each PTSD symptom cluster (Re-experiencing, Avoidance, and Sense of Threat), and endorsement of at least one indicator of functional impairment. The psychometric properties of the ITQ scores have been demonstrated in multiple general population [19, 20] and clinical and high risk samples [21,22]. The reliability of the PTSD items was high (α = .93).

Covid-19 related anxiety: The survey included a question "How anxious are you about the coronavirus COVID-19 pandemic?" and the participants were provided with a 'slider' (electronic visual analogue scale) to indicate their degree of anxiety with '0' and '100' at the left and right hand extremes respectively, and 10 point increments. This produced continuous scores ranging from 0 to 100 with higher scores reflecting higher levels of COVID-19 related anxiety. The scores were recoded into quintiles, and the upper quintile was considered to be indicative of 'COVID-19 anxiety'.

Similar recruitment strategies and measures have been used by international collaborators in other countries such as Ireland[10], Italy, Spain, Saudi Arabia and United Arab Emirates.

Analysis Plan

The analyses were conducted in 3 linked phases. First, the prevalence of generalised anxiety, depression and traumatic stress was estimated using the established cut-off scores. Second, the bivariate associations between the predictor variables and the mental health variables were calculated using logistic regression and the assocations were reported as odds ratios (ORs) with 95% confidence intervals (CI). Third, all predictor variables were entered simulataneously into multivariate binary logistic regression models to estimate the unique effect of each predictor variable, and the associations were reported as ORs.

Results

Based on the cut-off scores for the GAD-7 and the PHQ-9 the prevalence of depression was 22.1% (95% CI 20.3 - 23.9%) and for anxiety the prevalence was 21.6% (95% CI 19.8 - 23.4%). There was no significant difference between prevalence of depression for males and females (χ^2 (1) = 2.34, p = .12), but significantly more females (25.1%) screened positive for anxiety than males (17.9%: χ^2 (1) = 15.48, p < .001). A variable was computed to represent participants who

screened positive for the most common mental health disorders (Anxiety/Depression), either anxiety or depression, the prevalence for this was 27.7% (95% CI 25.8 - 29.7%), and the prevalence was higher for females (31.7%) than males (23.4%: (χ^2 (1) = 17.57, $p < .001$). Using the diagnostic algorithm for the ITQ the prevalence of traumatic stress was 16.79% (95% CI 15.2- 18.4%). There was a significant sex difference with a higher prevalence of traumatic stress for males (18.9%) compared to females (14.9%: χ^2 (1) = 5.85, $p < .01$). The COVID-19 anxiety prevalence was 21.3% (95% CI 19.5 - 23.1%) and there was a significant sex difference with a higher prevalence of COVID-19 anxiety for females (24.6%) compared to males (17.7%: χ^2 (1) = 5.85, $p < .01$).

Three binary logistic regression models were used to predict caseness on COVID-19 related anxiety, Anxiety/Depression, and traumatic stress. The predictor variables were age, gender, living location, lone adult, number of children, income, loss of income, pre-existing health condition (self and other), COVID-19 infection status (self and other), and personal risk of infection over the following month.

INSERT TABLE 1 ABOUT HERE

Table 1 shows the findings for COVID-19 related anxiety, stratified by the predictor variables, with bi-variate associations (unadjusted) presented as odds ratios (OR), and ORs from the multivariate (adjusted) model with all predictors entered. The multivariate model was significant (χ^2 (24) = 139.97, $p < .001$). When the unadjusted odds ratios were calculated, only female gender, the presence of children in the household and estimates of personal risks of infection were predictive of COVID-related anxiety. However, when the adjusted effects were calculated, the effect for the presence of children became stronger; there was an effect for a history of infection, which should be interpreted with caution in the light of the small numbers involved;

and there was a very strong effect for age, with older participants reporting more anxiety about the virus.

INSERT TABLE 2 AND 3 ABOUT HERE

The multivariate regression models for both Anxiety/Depression (χ^2 (24) = 292.03, $p < .001$), and traumatic stress (χ^2 (24) = 328.58, $p < .001$) were statistically significant, and the unadjusted and adjusted odds ratios are shown in Tables 2 and 3. For Anxiety/Depression there is a strong effect for age, but this runs contrary to the effect observed for COVID-related anxiety, with very high levels of psychological symptoms in the youngest participants and low levels in those above 65 years of age. A bivariate effect for urban location does not survive in the multivariate model, and the effect for having children in the house is much muted in the multivariate model. Participants who had lost income in the pandemic and those in the lower income categories showed markedly higher risk for anxiety/depression. Higher levels of Anxiety/Depression were also reported by those who had pre-existing health conditions, knew someone who had a pre-existing health condition, had become infected themselves and/or gave a high estimate of their personal risk of infection.

Finally, in the case of traumatic stress, there was again a higher prevalence in younger participants but the gender effect was reversed compared with Anxiety/Depression, with more symptoms being reported by males. The influence of the presence of children was marked for both the bivariate associations and the multivariate model, but there was little effect for income or loss of income when the other variables were controlled for. The lack of an association for being infected by COVID-19 in the multivariate model should be interpreted with caution given the small numbers involved and the wide confidence intervals. Trauma symptoms were also associated with the perception of a high risk of infection.

Discussion

This study study is one of the first to measure psychological disorders in a representative sample of the UK population during a pandemic. The study has the additional virtues of recruiting participants early in the crisis and using standardised measures, allowing follow-up at later stages. We found higher levels of anxiety, depression and traumatic stress than previously reported from general population based studies. Although previous studies have investigated the psychological impact of past pandemics, particularly the SARS and H1N1 pandemics in the Far East, they have mostly considered the effects on pandemic survivors and health professionals and the only population-based studies have not used standardised instruments. For example, a study in Taiwan following the 2003 SARS pandemic used a five-item symptom rating scale, finding that poorer mental health was related to personal experience of SARS or knowing people who had been affected [11]. In a Chinese study that employed a short questionnaire during the same pandemic, respondents reported increased fear, anxiety and panic [2]. However, a longitudinal study of citizens of Hong King during the 2009 H1N1 pandemic found low levels of anxiety throughout, but anxiety levels were associated with compliance with social distancing advice [1].

Our primary aim was to assess the levels of anxiety, depression, and traumatic stress in the population during the early stages of the COVID-19 pandemic. The prevalence of anxiety (21.63%) and depression (22.12%) found in this study appear to be higher than those previously reported, but not markedly so. The English 2014 Adult Psychiatric Morbidity Survey (APMS) [22] reported that 15.7% of the sample experienced symptoms of common mental health disorders, based on a cut-off score of 12 on the Clinical Interview Schedule- Revised, with a higher prevalence for women (19.1%) than men (12.2%). The prevalence of anxiety or depression from the Understanding Society study in 2014 was 19.7% (22.5% females, 16.8% males) [24] based on

the General Health Questionnaire (GHQ). The closest comparable study is probably the NIHR ARC North West Coast Household Health Survey, which administered the PHQ9 and GAD7 (although administered face-to-face) to 4,000 people in the North West of England, mainly living in deprived areas; in this study, 17% were depressed and 13% were anxious [25]. A recently published study used data from the 'Understanding Society COVID-19 web survey' and reported the population prevalence of clinically significant levels of mental distress to be 27·3%2[26]. The study used the GHQ to identify clinically significant distress, and data collection was approximately one month after our data collection period, but despite these differences the GHQ prevalence is similar to that based on meeting the criteria for either anxiety or depression in this study, which was 27.7%. This may be indicative of a stable psychological response during the first month of Lockdown, although longitudinal studies will be required to determine the longitudinal change during Lockdown.

The prevalence of PTSD in this current study was 16.79% and is similar to the combined prevalence of PTSD and Complex PTSD in a UK trauma exposed sample (PTSD prevalence of 5.3% and 12.9% for Complex PTSD [27]), and much higher than that reported from the APMS (4.4% and no gender differences were found[11]). However, these comparisons should be treated with caution as the status of COVID-19 as a traumatic stressor is not clear. Unexpectedly, the prevalence for males was higher than females; most epidemiological studies report higher prevalence of PTSD for females[28]. The reasons for this are not immediately clear, but the health and economic threat that COVID-19 poses, may be undermining traditional male gender roles, or the higher prevalence of mortality for males during the British COVID-19 pandemic may be playing a role.

The unadjusted estimates for the model predicting Anxiety/Depression revealed that younger age, being female, living in a city, pre-existing health conditions, COVID-19 status, and perceived risk of COVID-19 infection all significantly increased the likelihood of screening positive for anxiety or depression.

Contrary to expectations, the oldest age group and being male were associated with a lower likelihood of anxiety or depression, despite these factors being associated with a higher COVID-19 related mortality[29]. In the 2014 Adult Psychiatric Morbidity Survey, much lower prevalence of common psychological disorders were observed in those over 65 compared with those of working age, although the effect was nonlinear and the high prevalence observed for under 35s in this study were not evident there. Strikingly, the opposite relationship with age was observed for anxiety specifically about the COVID-19 pandemic, which was related to mortality risk in a logical way. The adjusted estimates were generally attenuated, but the same pattern of associations was found. The unadjusted estimates for the model predicting traumatic stress differed in that being male was a significant risk factor, and there was a large effect for living in an urban area.

This study has both strengths and limitations. On the strengths side, the sample was highly representative of the UK population, was recruited early in the progress of the pandemic, and used standardised measures, allowing comparisons with findings from later stages of the Covid-19 crisis. However, despite the sampling frame and large sample size, and although the participants in this study were representative of the UK population on demographic, economic and social factors, as well as voting history, it was not a true random probability sample (which would have been very difficult to obtain under the current circumstances) and it is possible that individuals' decisions about whether to participate were affected by psychological factors, creating the possibility of sampling bias. Second, all mental health assessments were based on

self-report and not clinician administered interviews, and this may have resulted in over-estimation of prevalence. Third, the validity of the assessment of traumatic stress may be questioned as it is not clear if the COVID-19 pandemic meets the ICD-11 criteria ("…an extremely threatening or horrific event or series of events") or DSM-5 criteria (direct exposure, witnessing the trauma, learning that a relative or close friend was exposed to a trauma, indirect exposure to aversive details of the trauma, usually in the course of professional duties) for a traumatic event for the entire population. This question is already being debated [30] with arguments being made that the global nature of the threat, its wide ranging effects (i.e. health, economic and social), and the widespread reports of behaviours and cognitions analogous to PTSD symptoms (heightened perceptions of threat, voluntary (and enforced) avoidance, and re-experiencing being facilitated by mainstream and social media), means that the pandemic should be considered a traumatic stressor. Finally, the mechanisms by which the threat of the pandemic and/or the quarantine influence mental health could not be established. Previous research has identified disruptions in the circadian rhythm[31], disruptions in social contact[32], and quarantine related stressors as important contributing factors[33].

Conclusions

Modelling studies have suggested that the impact of pandemics on psychological disorders in the general population may affect the progress of a pandemic and, therefore, indirectly affect mortality [6]. Furthermore, the development of psychological disorders in the population may create a burden that impedes national social and economic recovery once the pandemic ends. The fact that the prevalence of psychological problems observed in the present study was not dramatically higher than those reported in previous studies suggests that the population, at an early stage of the pandemic, has successfully adapted to the unprecedented changes that have been forced on their lifestyles. However, we have identified certain key groups who may be

more vulnerable to the social and economic challenges of the pandemic, particularly those whose income has been affected, who have children living in the home and who have pre-existing health conditions that make them vulnerable to the more devastating effects of the COVID-19 virus. Further research is needed to track whether these groups show higher levels of psychological problems at later stages in the pandemic and whether specific interventions and policies should be developed to address their needs.

References

1. Cowling BJ, Ng DMW, Ip DKM, et al. Community psychological and behavioral responses through the first wave of the 2009 influenza A (H1N1) pandemic in Hong Kong. Journal of Infectious Diseases. 2010;202:867-876.
2. Zhu X, Wu S, Miao D, Li Y. Changes in emotion of the Chinese public in regard to the SARS period. Social Behavior and Personality. 2008;36:447-454.
3. Chong MY, Wang WC, Hsieh WC, et al. Psychological impact of severe acute respiratory syndrome on health workers in a tertiary hospital. British Journal of Psychiatry. 2004;185:127-133.
4. Matsuishi K, Kawazoe A, Imai H, et al. Psychological impact of the pandemic (H1N1) 2009 on general hospital workers in Kobe. Psychiatry and Clinical Neurosciences. 2012;66:353-360.
5. Gardner PJ, Moallef P. Psychological impact on SARS survivors: Critical review of the English language literature. Canadian Psychology/Psychologie canadienne. 2015;56:123-135.
6. Funk S, Salathé M, Jensen VAA. Modelling the influence of human behaviour on the spread of infectious diseases: a review. Journal of the Royal Society Interface. 2010;7:1247-1256.
7. Naylor D, Basrur S, Bergeron MG, Brunham RC, Butler-Jones D, Dafoe G. Learning from SARS: Renewal of public health in Canada. Ottowa, Canada: National Advisory Committee on SARS and Public Health;2003.
8. Holmes EA, O'Connor RC, Perry VH, et al. Multidisciplinary research priorities for the COVID-19 pandemic: a call for action for mental health science. Lancet Psychiatry. 2020.

9. McBride O, Murphy J, Shevlin M, Gibson Miller J, Hartman TK, Hyland P, et al. Monitoring the psychological impact of the COVID-19 pandemic in the general population: an overview of the context, design and conduct of the COVID-19 Psychological Research Consortium (C19PRC) Study [Internet]. PsyArXiv; 2020. Available from: psyarxiv.com/wxe2n

10. Hyland P, Shevlin M, McBride O, Murphy J, Karatzias T, Bentall RP, Martinez A, Vallières F. Anxiety and depression in the Republic of Ireland during the COVID-19 pandemic. Acta Psychiatr Scand. 2020 Jul 27. doi: 10.1111/acps.13219. Online ahead of print.

11. Peng EY-C, L'ee M-B, Tsai S-T, et al. Population-based post-crisis psychological distress: An example from the SARS outbreak in Taiwan. Journal of the Formosan Mdical Association. 2010;109:524-532.

12. Fear NT, Bridges S, Hatch SL, Hawkins V, Wessely S. Posttraumatic stress disorder. In: McManus S, Bebbington P, Jenkins R, Brugha T, eds. Mental health and wellbeing in England: Adult Psychiatric Morbidity Survey 2014. LeedsNHS Digital2016.

13. Kroenke K, Spitzer R. The PHQ-9: A new depression diagnostic and severity measure. Psychiatric Annals. 2002;32:1-7.

14. Manea L, Gilbody S, McMillan D. Optimal cut-off score for diagnosing depression with the Patient Health Questionnaire (PHQ-9): a meta-analysis. Canadian Medical Association Journal. 2012;184:E191-E196.

15. National Collaborating Centre for Mental Health. Improving access to psychological therapies manual. 2018.

16. Spitzer RL, Kroenke K, Williams JBW, Löwe B. A brief measure for assessing generalized anxiety disorder. Archives of Internal Medficine. 2006;166:1092-1097.

17. Hinz A, Klien AM, Brähler E, et al. Psychometric evaluation of the Generalized Anxiety Disorder Screener GAD-7, based on a large German general population sample. Journal of Affective Disorders. 2017;210:338-344.

18. Cloitre M, Shevlin M, Brewin CR, et al. The International Trauma Questionnaire: development of a self-report measure of ICD-11 PTSD and complex PTSD. Acta Psychiatrica Scandinavica. 2018;138:536-546.

19. Ben-Ezra M, Karatzias T, Hyland P, et al. Posttraumatic stress disorder (PTSD) and complex PTSD(CPTSD) as per ICD-11 proposals: A population study in Israel. Depression and Anxiety. 2017;35:264-274.

20. Cloitre M, Hyland P, Bisson JI, et al. ICD-11 PTSD and Complex PTSD in the United States: A population-based study. Journal of Traumatic Stress. 2019.

21. Hyland P, Shevlin M, Brewin C, et al. Validation of post-traumatic stress disorder (PTSD) and complex PTSD using the International Trauma Questionnaire. Acta Psychiatrica Scandinavica. 2017;136:313-322.

22. Karatzias T, Shevlin M, Fyvie C, et al. An initial psychometric assessment of an ICD-11 based measure of PTSD and complex PTSD (ICD-TQ): Evidence of construct validity. Journal of Anxiety Disorders. 2016;44:73-79.

23. Stansfeld S, Clark C, Bebbington P, King M, Jenkins R, Hinchliffe S. Common mental disorders. In: McManus S, Bebbington P, Jenkins R, Brugha T, eds. Mental health and wellbeing in England: Adult Psychiatric Morbidity Survey 2014. Leeds: NHS Digital; 2016.

24. Evans J, Macrory I, Randall C. Measuring national wellbeing: Life in the UK, 2016. London2016.

25. Giebel C, Corcoran C, Goddall M, et al. Do people living in disadvantaged circumstances receive different mental health treatments than those from less disadvantaged backgrounds? BMC Public Health. in press.

26. Pierce M, Hope H, Ford T, Hatch S, Hotopf M, John A, Kontopantelis E, Webb R, Wessely S, McManus S, Abel KM. Mental health before and during the COVID-19 pandemic: a longitudinal probability sample survey of the UK population. The Lancet Psychiatry. 2020 Jul 21.

27. Karatzias T, Hyland P, Bradley A, et al. Risk factors and comorbidity of ICD-11 PTSD and complex PTSD: Findings from a trauma-exposed population based sample of adults in the United Kingdom. Depression and Anxiety. 2019;36:887-894.

28. Olff M. Sex and gender differences in post-traumatic stress disorder: an update. European Journal of Psychotraumatology. 2017;8 (Suppl 4):1351204.

29. Wang W, Tang J, Wei F. Updated understanding of the outbreak of 2019 novel coronavirus (2019-nCoV) in Wuhan, China. Journal of Medical Virology. 2020;92:441-447.

30. Horesh D, Brown AD. Traumatic stress in the age of COVID-19: A call to close critical gaps and adapt to new realities. Psychological Trauma: Theory, Research, Practice, and Policy. 2020 May;12(4):331.

31. Tao S, Wu X, Li S, Ma L, Yu Y, Sun G, Tao FB. Associations of Circadian Rhythm Abnormalities Caused by Home Quarantine During the COVID-19 Outbreak and Mental Health in Chinese Undergraduates: Evidence from a Nationwide School-Based Survey. Available at SSRN 3582851. 2020 Apr 17.

32. Brooks SK, Webster RK, Smith LE, Woodland L, Wessely S, Greenberg N, Rubin GJ. The psychological impact of quarantine and how to reduce it: rapid review of the evidence. The Lancet. 2020 Feb 26.

33. Usher, K., Bhullar, N. and Jackson, D. (2020), Life in the pandemic: Social isolation and mental health. J Clin Nurs. doi:10.1111/jocn.15290

Table 1: Bivariate and Multivariate Binary Logistic Regression Results Predicting COVID-Related Anxiety

		COVID-19 Anxiety	Unadjusted OR	Adjusted OR
	N	N (%)		
Age				
18-24	246	42 (17.1%)	-	-
25-34	380	66 (17.4%)	1.02 (.667 - 1.56)	.93 (.59 - 1.46)
35-44	353	75 (21.2%)	1.31 (.86 - 1.99)	1.40 (.88 - 2.21)
45-54	410	96 (23.4%)	1.48 (.99 - 2.22)	1.99 (1.28 - 3.07)**
55-64	349	84 (24.1%)	1.54 (1.02 - 2.33)*	2.58 (1.63 - 4.08)***
65+	287	68 (23.7%)	1.51 (.98 - 2.32)	2.42 (1.50 - 3.91)***
Gender				
Female	1047	258 (24.6%)	-	-
Male	972	172 (17.7%)	.65 (.53 - .82)***	.586 (.463 - .743)***
Living location				
Rural	335	74 (22.1%)	-	-
Town	620	130 (21.0%)	.94 (.68 - 1.29)	.92 (.65 - 1.29)
Suburb	572	106 (18.5%)	.80 (.57 - 1.12)	.77 (.54 - 1.09)
City	498	121 (24.3%)	1.13 (.81 - 1.57)	1.20 (.84 - 1.71)
Lone Adult				
No	1571	337 (21.5%)	-	-
Yes	454	94 (20.7%)	.96 (.740 - 1.24)	.971 (.716 - 1.317)
Children				
0	1429	283 (19.7%)	-	-
1	292	56 (19.1%)	.96 (.70 - 1.32)	1.09 (.77 - 1.55)
2	237	73 (30.7%)	1.80 (1.33 - 2.44)***	2.11 (1.49 - 2.98)***
3 +	61	19 (31.1%)	1.84 (1.05 - 3.21)*	2.35 (1.29 - 4.28)**
Income				
£57,930 +	410	77 (18.8%)	-	-
- £57,930 pa	410	86 (21.0%)	1.15 (.81 - 1.62)	1.15 (.80 - 1.65)
- £38,740 pa	385	88 (22.9%)	1.28 (.91 - 1.81)	1.40 (.97 - 2.03)
- £25,340 pa	410	86 (21.0%)	1.15 (.82 - 1.62)	1.37 (.94 - 2.02)
£0 - 15,490 pa	410	94 (22.9%)	1.29 (.92 - 1.80)	1.30 (.881 - 1.92)
Lost income				
Not lost	1377	282 (20.5%)	-	-
Lost	648	149 (23.0%)	1.16 (.93 - 1.45)	1.18 (.93 - 1.51)
Pre-existing health condition, self				
No	1714	348 (20.3%)	-	-
Yes	311	83 (26.7%)	1.43 (1.08 - 1.89)*	1.24 (.91 - 1.69)

Pre-existing health condition, someone close				
No	1510	305 (20.2%)	-	-
Yes	515	126 (24.5%)	1.28 (1.01 - 1.62)*	1.07 (.82 - 1.39)
COVID-19 Self				
No	1977	425 (21.5%)	-	
Yes	48	6 (12.5%)	.52 (.22 - 1.23)	.39 (.16 - .99)*
Covid-19 Someone close				
No	1913	407 (21.3%)	-	-
Yes	112	24 (21.4%)	1.01 (.63 - 1.61)	.89 (.54 - 1.45)
Personal Risk 1month				
Low	633	81 (12.8%)	-	
Moderate	867	182 (21.0%)	1.81 (1.36 - 2.41)***	1.75 (1.31 - 2.34)***
High	525	168 (32.0%)	3.21 (2.38 - 4.31)***	3.14 (2.31 - 4.28)***

* p <.05, ** p <.01, ***p <.001.

Table 2: Bivariate and Multivariate Binary Logistic Regression Results Predicting Anxiety/Depression

		Anxiety/ Depression	Unadjusted OR	Adjusted OR
	N	N (%)		
Age				
18-24	246	121 (49.2%)	-	-
25-34	380	152 (40.0%)	.69 (.50 -.95)*	.67 (.47 -.95)*
35-44	353	97 (27.5%)	.39 (.278 - .551)***	.408 (.28 - .60)***
45-54	410	96 (23.4%)	.32 (.22 - .44) ***	.36 (.25 - .52)***
55-64	349	68 (19.5%)	.25 (.17 - .36) ***	.31 (.21 - .47)***
65+	287	28 (9.8%)	.11 (.07 - .18) ***	.141 (.09 - .23)***
Gender				
Female	1047	227 (23.4%)	-	-
Male	972	332 (31.70%)	.65 (.54-.80)***	.89 (.71 -1.12)
Living location				
Rural	335	77 (23.0%)	-	-
Town	620	167 (26.9%)	1.23 (.91 - 1.68)	1.02 (.73 -1.43)
Suburb	572	138 (24.1%)	1.06 (.77 - 1.46)	.98 (.70 - 1.39)
City	498	180 (36.1%)	1.90 (1.39 -2.59)***	1.21 (.86 -1.7)
Lone Adult				
No	1571	424 (27.0%)	-	-
Yes	454	138 (30.4%)	1.18 (.94 - 1.48)	1.32 (.99 - 1.75)
Children				
0	1429	355 (24.8%)	-	-
1	292	95 (32.4%)	1.46 (1.11 - 1.91)**	1.19 (.88 – 1.61)
2	237	90 (37.8%)	1.84 (1.38 - 2.46)***	1.41 (1.01 – 1.96)*
3 +	61	22 (36.1%)	1.71 (1.00 - 2.93)*	1.41 (.79 – 2.53)
Income				
£57,930 +	410	70 (17.1%)	-	-
- £57,930 pa	410	91 (22.2%)	1.39 (.98 - 1.96)	1.28 (.89 - 1.85)
- £38,740 pa	385	117 (30.4%)	2.12 (1.51 - 2.97)***	1.69 (1.17 – 2.44)**
- £25,340 pa	410	135 (32.9%)	2.38 (1.71 - 3.31)***	1.67 (1.15 – 2.42)**
£0 - 15,490 pa	410	149 (36.3%)	2.77 (2.00 - 3.84)***	2.44 (1.67 - 3.56)***
Lost income				
Not lost	1377	323 (23.5%)	-	-
Lost	648	239 (36.9%)	1.91 (1.56 - 2.33)***	1.25 (1.25 – 1.95)***
Pre-existing health condition, self				
No	1714	452 (26.4%)	-	-
Yes	311	110 (35.4%)	1.53 (1.18 - 1.97)**	1.45 (1.07 -1.96)*

Pre-existing health condition, someone close				
No	1510	386 (25.6%)	-	-
Yes	515	176 (34.2%)	1.51 (1.22 - 1.88)***	1.33 (1.03 - 1.74)*
COVID-19 Self				
No	1977	535 (27.1%)	-	
Yes	48	27 (56.3%)	3.46 (1.94 - 6.18)***	2.17 (1.14 - 4.11)**
Covid-19 Someone close				
No	1913	515 (26.9%)	-	-
Yes	112	47 (42.0%)	1.96 (1.33 - 2.89)**	1.50 (.97 - 2.32)
Personal Risk 1month				
Low	633	139 (22.0%)	-	-
Moderate	867	208 (24.0%)	1.12 (.88 - 1.43)	1.13 (.87 - 1.47)
High	525	215 (41.0%)	2.46 (1.91 - 3.18)***	2.20 (1.66 - 2.91)***

* p <.05, ** p <.01, ***p <.001.

Table 3. Bivariate and Multivariate Binary Logistic Regression Results Predicting Traumatic Stress

		Traumatic Stress	Unadjusted OR	Adjusted OR
	N	N (%)		
Age				
18-24	246	59 (24.0%)	-	-
25-34	380	109 (28.7%)	1.27 (.88 - 1.84)	.99 (.65 - 1.49)
35-44	353	88 (24.9%)	1.05 (.72 - 1.54)	.74 (.48 - 1.15)
45-54	410	53 (12.9%)	.47 (.31 - .71)***	.39 (.25 - .62)***
55-64	349	24 (6.9%)	.23 (.14 - .39)***	.31 (.18 - .54)***
65+	287	7 (2.4%)	.08 (.03-.18)***	.09 (.04 - .22)***
Gender				
Female	1047	156 (14.9%)	-	-
Male	972	184 (18.9%)	1.33 (1.06 - 1.68)*	1.85 (1.41 - 2.44) ***
Living location				
Rural	335	36 (10.7%)	-	-
Town	620	76 (12.3%)	1.16 (.76 - 1.77)	.94 (.60 - 1.50)
Suburb	572	88 (15.4%)	1.51 (.99 - 2.28)	1.24 (.79 - 1.94)
City	498	140 (28.1%)	3.25 (2.18 - 4.83)***	1.91 (1.23 - 2.94)**
Lone Adult				
No	1571	268 (17.1%)	-	-
Yes	454	72 (15.9%)	.92 (.69 – 1.22)	1.412 (.99 – 2.00)
Children				
0	1429	163 (11.4%)	-	-
1	292	75 (25.6%)	2.68 (1.96 - 3.65)***	1.83 (1.30 – 2.58)**
2	237	83 (34.9%)	4.17 (3.05 - 5.70)***	2.56 (1.78 – 3.68)***
3 +	61	19 (31.1%)	3.52 (2.00 - 6.21)***	2.39 (1.29 – 4.44)**
Income				
£57,930 +	410	49 (12.0%)	-	-
- £57,930 pa	410	59 (14.4%)	1.24 - (.82 - 1.86)	1.27 (.82 – 1.98)
- £38,740 pa	385	81 (21.0%)	1.96 (1.33 - 2.88)**	1.55 (.99- 2.40)
- £25,340 pa	410	98 (23.9%)	2.31 (1.59 - 3.36)***	1.85 (1.19 - 2.87)**
£0 - 15,490 pa	410	53 (12.9%)	1.09 (.72 - 1.65)	1.28 (.78 – 2.07)
Lost income				
Not lost	1377	196 (14.2%)	-	-
Lost	648	144 (22.2%)	1.722 (1.36 - 2.18)***	1.27 (.97 – 1.66)

Pre-existing health condition, self				
No	1714	279 (16.3%)	-	-
Yes	311	61 (19.6%)	1.25 (.92 - 1.71)	1.21 (.829 - 1.77)
Pre-existing health condition, someone close				
No	1510	247 (16.4%)	-	-
Yes	515	93 (18.1%)	1.13 (.87 - 1.46)	1.13 (.82 - 1.56)
Covid-19 Self				
No	1977	324 (16.4%)	-	-
Yes	48	16 (33.3%)	2.55 (1.38 - 4.70)**	1.03 (.50 - 2.12)
Covid-19 Someone close				
No	1913	305 (15.9%)	-	-
Yes	112	35 (31.3%)	2.39 (1.57 - 3.64)***	1.70 (1.04 - 2.77)*
Personal Risk 1month				
Low	633	54 (8.5%)	-	-
Moderate	867	132 (15.2%)	1.92 (1.37 - 2.69)***	1.88 (1.32 - 2.68)**
High	525	154 (29.3%)	4.45 (3.18 - 6.23)***	3.55 (2.47 - 5.09)***

* p <.05, ** p <.01, ***p <.001.

Author Contribution

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