Trajectories of depression and anxiety during enforced isolation due to COVID-19: longitudinal analyses of 59,318 adults in the UK with and without diagnosed mental illness

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Abstract

Background: There is currently major concern about the impact of the global COVID-19 outbreak on mental health. A number of studies suggest that mental health deteriorated in many countries prior to enforced isolation (“lockdown”), but it remains unknown how mental health has changed during lockdown.

Aims: This study explored trajectories of anxiety and depression over the first two months of lockdown using data from the UK, and compared the experiences of individuals with and without diagnosed mental illness.

Methods: Data from 53,328 adults in the UCL COVID-19 Social Study (a well-stratified panel study weighted to population proportions collecting data weekly during the Covid-19 pandemic) were analysed from 21/03/2020-10/05/2020. Growth curve modelling was fitted accounting for socio-demographic and health covariates.

Results: 24.4% of the sample had scores indicating moderate-severe anxiety, and 31.4% indicating moderate-severe depressive symptoms. Over the first two months of lockdown, there was only a slight decrease in anxiety levels amongst participants as a whole and a very small decrease in depression levels between weeks 3-6 that then increased again in weeks 7-8. Adults with pre-existing diagnoses of mental health conditions had higher levels of anxiety and depression but there was no evidence of widening inequalities in mental health experiences compared to people without existing mental illness.

Conclusions: Results suggest there has been little improvement in depression and only slight improvements in anxiety since lockdown commenced in the UK. These findings suggest greater efforts need to be made to help individuals manage their mental health during the pandemic.

Keywords: COVID-19, mental health, depression, anxiety, social isolation, lockdown, pandemic
Introduction

In the first few months of 2020, risks of infection from COVID-19 and overwhelming of healthcare resources have led to the largest enforced isolation period in human history. “Stay-at-home” orders have been issued by governments in a number of countries, whilst individuals who have been potentially exposed to the virus are being ordered to quarantine, and individuals who are showing symptoms or testing positive are being ordered to entirely self-isolate from others. This has led to widespread concern for how people’s mental health is going to be affected ¹, and a call for urgent mental health research ².

There are limited data from previous epidemics on the effects of quarantine or enforced isolation due to outbreaks on mental health. Small cross-sectional studies of the SARS outbreak reported associations between length of quarantine and symptoms of depression and PTSD amongst adults who had to quarantine for 10 days in Toronto ³,⁴, between restrictions in going out and the presence of psychological disorders 7-8 months following isolation amongst workers in Beijing ⁵, and between being quarantined during the outbreak and depressive symptoms 3 years later amongst hospital workers in Beijing ⁶,⁷. Other qualitative or self-report studies of various epidemics reported symptoms such as psychological distress, emotional exhaustion and anger ⁸. However, some other studies of quarantine have not reported adverse effects. For example, a cross-sectional study of students during the H1N1 flu pandemic found no difference in PTSD symptoms or psychological consequences amongst those who were and were not quarantined ⁹. So it is not entirely clear, based on past experiences, how mental health is affected by periods of enforced isolation.

To date, there have been little data on the mental health impact of COVID-19 amongst people staying at home (i.e. non healthcare workers). A study of 333 adults in China assessed during the initial outbreak and at the epidemic’s peak four weeks later reported decreases in PTSD symptoms, but no changes over time in anxiety, stress or depression ¹⁰. Further, polling data in Britain suggested deterioration in mental health in the UK prior to stay-at-home orders ("lockdown") coming in. For example, a mood poll in Britain showed a large decrease in happiness in early March (from 50% on 6th-9th March to 25% on 20th-23rd March), prior to lockdown coming in, alongside an increase in fear and boredom ¹¹,¹². A cross-sectional general public survey also found that 62% of UK adults felt anxious in the week preceding lockdown, while 22% felt panicked and 18% felt hopeless, while another survey found that in the first week of lockdown, 20% of adults in the UK were worried about mental illness ¹³,¹⁴. Further polling has suggested that nearly half of the UK population has experienced high levels of anxiety since lockdown commenced ¹⁵. While these studies have relied on single item self-reports, a small cross-sectional study of 2,000 people carried out in the first 4 days of lockdown using standardised measures found that 25% of women and 18% of men were showing clinically meaningful symptoms of anxiety, and 23% of women and 21% of men showing symptoms of depression ¹⁶. Nevertheless, it remains unknown how mental health was affected during the first two months of lockdown in the UK: whether it continued to worsen, or whether there were any patterns of stabilisation or returns to people’s usual mental health levels prior to COVID-19.

Further, an important question is whether individuals with a history of mental illness were more adversely affected during this early period of isolation. In previous studies of epidemics, there has been some indication that pre-existing psychiatric conditions are a risk factor for poorer outcomes, with a history of mental illness being associated with a 4-5 times higher relative risk of experiencing anxiety or anger 4-6 months following the end of isolation due to Middle
East Respiratory Syndrome. A cross-sectional study on COVID-19 from the US also reported a relationship between anxiety specifically over COVID-19 and general levels of anxiety and depression. While it is expected that people with diagnosed mental illness will have higher levels of symptoms relative to people without diagnoses, it’s unclear how trajectories might vary over time, and in particular whether differences in anxiety and depression between those with and without diagnoses will remain constant or change over time. This is important to ascertain so as to identify who is most at risk and what support is most needed both during the ongoing pandemic and in preparing for future pandemics.

Therefore, this study involved analyses of data from a longitudinal study of nearly 60,000 adults living in the UK during the government-enforced lockdown in the COVID-19 pandemic. The study had two main aims: (i) to explore trajectories of anxiety and depression over the first two months of this lockdown, and (ii) to compare the experiences of individuals with and without diagnosed mental illness. We used well-established questionnaire measures of depression and anxiety to avoid the limitations of single item assessments included in some previous reports.

Methods

Participants

Data were drawn from the UCL COVID-19 Social Study; a large panel study of the psychological and social experiences of over 50,000 adults (aged 18+) in the UK during the COVID-19 pandemic. The study commenced on 21st March 2020 involving online weekly data collection from participants during the COVID-19 pandemic. Whilst not random, the study has a well-stratified sample that was recruited using three primary approaches. First, snowballing was used, including promoting the study through existing networks and mailing lists (including large databases of adults who had previously consented to be involved in health research across the UK), print and digital media coverage, and social media. Second, more targeted recruitment was undertaken focusing on (i) individuals from a low-income background, (ii) individuals with no or few educational qualifications, and (iii) individuals who were unemployed. Third, the study was promoted via partnerships with third sector organisations to vulnerable groups, including adults with pre-existing mental illness, older adults, and carers. The study was approved by the UCL Research Ethics Committee [12467/005] and all participants gave informed consent.

For these analyses, we focused on participants recruited between 21st March and 10th May 2020, which provided us with data from 59,318 respondents. Of these, 10% participants withheld data on demographic factors including gender and income so were excluded, providing a final analytic sample size of 53,328. Further detail on the sample is available in Supplementary Material.

Measures

Depression was measured using the Patient Health Questionnaire (PHQ-9); a standard instrument for diagnosing depression in primary care. The questionnaire involves nine items, with responses ranging from “not at all” to “nearly every day”. Higher overall scores indicate more depressive symptoms, with scores of 0-4 suggesting minimal depression, 5-9 mild depression, 10-14 moderate depression, 15-19 moderately severe depression, and 20-27 severe depression.
Anxiety was measured using the Generalised Anxiety Disorder assessment (GAD-7); a well-validated tool used to screen and diagnose generalised anxiety disorder in clinical practice and research. There are 7 items with 4-point responses ranging from “not at all” to “nearly every day”, with higher overall scores indicating more symptoms of anxiety. Scores of 5-9 are thought to represent mild anxiety, 10-14 moderate anxiety, and 15 and above severe.

We included socio-demographic variables as time-invariant covariates, including gender (men vs. women), age groups (18-29, 30-45, 46-59 and 60+), ethnicity (white vs. other ethnicities), education (GCSE or below [equivalent to education to age 16], A levels or equivalent [equivalent to education to age 18], degree or above [further education after the age of 18]), low income (household income <£30,000 vs higher) and living arrangement (alone, not alone with no child in the household, not alone with children). We also assessed whether participants had experienced symptoms of COVID-19. Whilst this is likely not an accurate representation of actual cases as some symptoms may not have been indicative of COVID-19 whilst other cases may have been asymptomatic, it does give an indication as to whether individuals had feelings of being unwell that caused concern in relation to the virus. Finally, we assessed diagnosed mental illness through participant report of clinical diagnoses using three categories: clinically-diagnosed depression, clinically-diagnosed anxiety, or other clinically-diagnosed psychiatric conditions (yes/no). Further detail on the measures is available in Supplementary Material.

Analysis

Data were analysed using growth curve modelling which allowed us to estimate the inter-individual heterogeneity in intra-individual changes over time. The general equations were presented as below:

\[ Y_{ij} = \pi_{0i} + \pi_{1i} \text{wave}_{ij} + \pi_{2i} \text{wave}_{ij}^2 \left( + \pi_{3i} \text{wave}_{ij}^3 + \pi_{4i} \text{wave}_{ij}^4 \right) + \epsilon_{ij} \]  

(1-1)

\[ \pi_{0i} = \gamma_{00} + \gamma_{01} \text{day}_{i} + \gamma_{02} X_i + \gamma_{03} X_{ij} + \zeta_{0i} \]  

(1-2)

\[ \pi_{1i} = \gamma_{10} + \gamma_{11} \text{day}_{i} + \gamma_{12} X_i + \gamma_{13} X_{ij} + \zeta_{1i} \]  

(1-3)

\[ \pi_{2i} = \gamma_{20} + \gamma_{21} \text{day}_{i} + \gamma_{22} X_i + \gamma_{23} X_{ij} + \zeta_{2i} \]  

(1-4)

Equation 1-1 addressed intra-individual changes where \( Y_{ij} \), depression or anxiety for the individual \( i \) at time \( j \), is a function of time and time squared. In addition, we also tested cubic and quartic terms. \( \pi_{0i} \) represented the individual \( i \)'s initial status. \( \pi_{1i} \) and \( \pi_{0i} \) represented growth rates and \( \epsilon_{ij} \) was the residual term. Equation 1-2, 1-3, and 1-4 addressed inter-individual differences in the initial status and growth rates. \( \gamma_{00}, \gamma_{10}, \gamma_{20} \) represented the population average initial status and growth rates. \( X_i \) represented a vector of time-invariant variables that hypothetically influence the initial status and growth rates. \( X_{ij} \) represented a vector of time-variant variables, which in this study was solely diagnosed or suspected covid-19 cases. \( \zeta_{0i}, \zeta_{1i}, \) and \( \zeta_{2i} \) were parameter residuals.

For our main analyses, wave was used to indicate survey completion each week (with wave 1 indicating the first time a participant completed the survey and wave 2 indicating the second time etc). As participants joined the study at different dates, we controlled for the number of days since the lockdown began on 23rd March 2020. For a sensitivity analysis we instead used calendar week from the start of lockdown as the time variable. This showed no material differences (see Supplementary Material).
Our 53,328 participants provided a total of 202,673 observations (mean 3.8 per participant). To account for the non-random nature of the sample, all data were weighted to the proportions of gender, age, ethnicity, education and country of living obtained from the Office for National Statistics (ONS, 2018). All analyses were carried out using Stata v15 (StataCorps, Texas).

**Results**

**Demographics**

Table 1 presents the characteristics of participants. In the raw data, 73% of participants were women and there was an over-representation of people with a degree or above (67%) and an under-representation of people from ethnic minority background (5%). After weighting, the sample was well balanced, reflecting population proportions, with 48% of women, 33% of participants with a degree or above, and 12% of non-white ethnicity. 11% of the sample reported believing they had experienced symptoms relating to COVID-19, although this did not necessarily equate to experiencing COVID-19. 20% of the sample reporting having a diagnosed mental illness.

| Table 1: Descriptive statistics of the explanatory variables for participants at Wave 1 |
|-----------------------------------|----------|----------|
|                                    | Raw data | Weighted data |
| Gender, female                     |          |            |
|                                   | %        | %          |
| Gender, female                     | 73       | 48        |
| Age                                |          |            |
| 18-29                              | 10       | 18        |
| 30-45                              | 31       | 27        |
| 46-59                              | 30       | 24        |
| 60+                                | 30       | 31        |
| Ethnicity, white                   |          |            |
|                                   | %        |            |
| Ethnicity, white                   | 95       | 88        |
| Education                          |          |            |
| GCSE or below                      | 15       | 33        |
| A-levels or equivalent             | 18       | 34        |
| Degree or above                    | 67       | 33        |
| Low household income (<30k)        | 40       | 49        |
| Living status                      |          |            |
| Alone                              | 19       | 19        |
| With others (not children)         | 52       | 54        |
| With others (including children)   | 29       | 27        |
| Experienced symptoms of Covid-19 during follow-up | 11 | 11 |
| Diagnosed mental illness           | 19       | 20        |

**Mental health**

In total, 24.4% of the sample had a score ≥10 indicating moderate or severe anxiety at their first wave of data collection (average score 5.9 ± 5.8), and 31.4% of the sample had a score ≥10 indicating moderate or severe depressive symptoms (average score 7.4 ± 6.5) (Table 2). Amongst people with a pre-existing diagnosed mental illness, 56.3% had a score ≥10 indicating at least moderate anxiety (average score 10.9 ± 6.2) and 67.4% had a score
≥10 indicating moderate or severe depression (average score 13.3 ± 6.9). Amongst people without a pre-existing diagnosed mental illness, these figures were 16.3% for anxiety (average score 4.7 ± 5.0) and 22.3% for depression (average score 5.9 ± 5.5). Further descriptive statistics are shown in Supplementary Table 1.

Table 2: Levels of anxiety and depression in the sample (weighted)

|                      | Total sample | Without pre-existing diagnosed mental illness | With pre-existing diagnosed mental illness |
|----------------------|--------------|-----------------------------------------------|-------------------------------------------|
| Anxiety              |              |                                               |                                           |
| Average score ± SD (% ≥10) | 5.9 ± 5.8 (24.4%) | 4.7 ± 5.0 (16.3%) | 10.9 ± 6.2 (56.3%) |
| Depression           |              |                                               |                                           |
| Average score ± SD (% ≥10) | 7.4 ± 6.5 (31.4%) | 5.9 ± 5.5 (22.3%) | 13.3 ± 6.9 (67.4%) |

Over the first two months of lockdown, there was a slight decrease in anxiety levels amongst participants as a whole and a very slight decrease followed by a very gradual increase in depression levels (Figure 1). But broadly levels did not improve.

Table 3: Results from growth curve models of anxiety and depression (weighted)

|                      | Anxiety | Depression |
|----------------------|---------|------------|
|                      | Coef.   | SE | P   | Coef. | SE | P   |
| Time (wave)          | -0.39   | 0.02| 0.000| -0.26 | 0.02| 0.000|
| Time-squared (wave²) | 0.03    | 0.00| 0.000| 0.03  | 0.00| 0.000|
| Diagnosed mental illness | 5.26 | 0.11| 0.000| 5.99  | 0.12| 0.000|
| Time*mental illness  | -0.06   | 0.02| 0.006| -0.03 | 0.02| 0.129|

Notes: Both the anxiety and depression model controlled for covariates, including gender, age, ethnicity, education, income, living status and Covid-19 symptoms. See Table S1 in the Supplement for the full model results.

People with pre-existing diagnosed mental illness had higher levels of both anxiety and depression. They also experienced slightly greater decreases in anxiety (wave*mental illness: coef -0.06 ± 0.02, p<.001), but no evidence of differences was found for depression (wave*mental illness: coeff -0.03 ± 0.02, p>0.05) (Table 3).
Discussion

This study is the first globally to look longitudinally at trajectories of anxiety and depression during lockdown due to COVID-19. Results show that while anxiety levels have gradually declined, there has been little improvement in depression. Adults with pre-existing diagnoses of mental illness had higher levels of anxiety and depression over this period. However, there was little evidence of substantially widening inequalities in mental health experiences over lockdown amongst those with and without existing mental illness.

The study did not use a random population sample, and therefore our reported statistics are not presented as prevalence levels for anxiety or depression. It is notable that the averages for both anxiety and depression appear higher than previously reported averages in nationally-representative samples of other western countries such as the US. This echoes reports from other studies in the UK and internationally. But it remains for future representative studies to confirm relative population levels of mental illness. However, this study does give detailed time series data on trajectories of mental health during lockdown. Several surveys have suggested that mental health worsened in the lead up to lockdown, and the results presented here suggest that there has been little tangible improvement in the weeks immediately following lockdown. This is echoed by mood data showing little improvement over the same period, particularly in happiness (see Supplementary Figure 1). The fact that levels of mental health did not continue to worsen even further in this period suggests a process of adaptation that bears similarities to literature on other types of isolation such as incarceration, where some studies have shown that depression levels can stabilise and even decrease on average month on month as new coping strategies emerge. Alternatively, it is also possible that measures to safeguard jobs and finances taken in the UK may have helped to settle specific anxieties. The lockdown itself may also have reduced worries about individuals or their friends or families catching the virus.
especially after the first two weeks of lockdown once individuals could be more confident they were outside of the incubation period. However, the lack of change over time in mental health during lockdown suggests that the shock of the pandemic has not been transient.

This study also found little difference in trajectories between people with and without a diagnosed mental health condition. Studies of previous epidemics have shown that pre-existing psychiatric conditions are a risk factor for poorer outcomes \(^{17}\), and this has been echoed in studies from various countries of COVID-19 \(^{25}\). However, longitudinal data tracking experiences in detail over the course of global disasters are limited. So there is little data against which to compare findings. However, it is notable that individuals with diagnosed mental health conditions did have slightly greater decreases in anxiety. Anxiety and depression can predispose individuals (in particular men) to greater stress reactivity \(^{29}\). So it is possible that individuals with diagnosed mental health conditions experienced greater increases in anxiety in the lead-up to lockdown coming in, and then subsequently had greater recoveries, as captured in the data presented here. Whilst it might seem encouraging that there is not currently evidence of widening disparities in experience between those with and without diagnosed conditions, future analyses of population cohort studies are required to identify if levels for individuals with pre-existing mental illness have shown a greater increase from usual baselines than levels for people without mental illness.

Strengths of this study include its large sample size with wide heterogeneity, including good stratification across all major socio-demographic groups. Further, analyses were weighted on the basis of population estimates of core demographics, with the weighted data showing good alignment with population demographics. The study also used established measures of anxiety and depression. But it is possible that the study inadvertently attracted individuals experiencing more extreme psychological experiences, with subsequent weighting for demographic factors failing to fully compensate for these differences. However, if this was the case, we might have expected this bias to affect both those with and without a diagnosed mental illness. So it is likely to have affected the average scores more than the trajectories over time. Nevertheless, as the study was internet based, participants without home access to internet were not represented. As this group is likely to include individuals who may be especially vulnerable, the estimates here may not be fully representative of experiences during the pandemic. Additionally, we relied on participant self-report of diagnosed mental illness. As such, we were unable to confirm diagnoses, nor identify specifically the type of problem participants had previously been diagnosed with. We also asked about current diagnoses, so we do not know how trajectories were affected by previous histories of mental illness, and as participants have entered the study continuously throughout the seven-week follow-up period reported here, it is possible that diagnoses have arisen since lockdown began. Future studies are recommended to look at specific type of psychiatric diagnosis in relation to mental health to identify if there are particularly psychopathologies associated with poorer trajectories over this period. As this study involved repeated weekly assessment of mental health, regression to the mean is a further source of bias that warrants acknowledgement. In particular for depression levels amongst individuals without pre-existing diagnosed mental illness, this could account for the very subtle changes noted. However, with regression to the mean we might have expected to see clearer decreases towards more average levels of symptoms, but as this was not seen, it suggests that symptoms of anxiety and depression did persist over this period with little improvement.

Overall, these findings suggest that there was little improvement in symptoms of depression and only slight improvements in anxiety over the early weeks of lockdown for COVID-19. People with pre-existing mental health
diagnoses experienced higher overall symptoms in this period, but had little difference in overall trajectories, other than a slightly greater decrease in anxiety, but this greater decrease is unlikely to be of clinical significance. Our results are important when considering the impact of lockdown measures as they suggest that mental health is currently not improving in a meaningful way for individuals. They also suggest greater efforts need to be made to help all individuals (both those with and without mental illness) manage their mental health during the pandemic. The results also have implications for future preparing for pandemics, suggesting the importance of providing mental health support in the early stages of outbreaks.

Declarations

Ethics approval and consent to participate

Ethical approval for the COVID-19 Social Study was granted by the UCL Ethics Committee. All participants provided fully informed consent. The study is GDPR compliant.

Data availability

Anonymous data will be made available following the end of the pandemic.

Declaration of interest

All authors declare no conflicts of interest.

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Author contributions

DF, AS and FB conceived and designed the study. FB analysed the data and DF wrote the first draft. All authors provided critical revisions. All authors read and approved the submitted manuscript.

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