


# BMJ Open Psychiatric manifestations and associated risk factors among hospitalised patients with COVID-19 in Edo State, Nigeria: a cross-sectional study

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## ABSTRACT

**Objective** To estimate the prevalence of depression and anxiety and identify associated risk factors in hospitalised persons with confirmed COVID-19 in Edo, Nigeria.

**Design** A multicentre cross-sectional survey.

**Setting** Patients with COVID-19 hospitalised at the three government-designated treatment and isolation centres in Edo State, Nigeria.

**Participants** The study was conducted from 15 April to 11 November 2020 among 489 patients with confirmed COVID-19 and in treatment and isolation centres in Edo State, Nigeria. The mean age of participants was 43.39 (SD=16.94) years. Male participants were 252 (51.5%) and female were 237 (48.5%).

**Main outcome measures** The nine-item Patient Health Questionnaire for depression, (total score: 0–27, depression  $\geq 10$ ), Generalized Anxiety Disorder-7 for anxiety (total score: 0–21, anxiety  $\geq 10$ ), and social demographic and clinical characteristics for associated risk factors.

**Results** Of the 489 participants, 49.1% and 38.0% had depressive and anxiety symptoms, respectively. The prevalence rates of depression, anxiety and combination of both were 16.2%, 12.9% and 9.0%, respectively. Moderate-severe symptoms of COVID-19,  $\geq 14$  days in isolation, worrying about the outcome of infection and stigma increased the risk of having depression and anxiety. Additionally, being separated/divorced increased the risk of having depression and having comorbidity increased the risk of having anxiety.

**Conclusion** A substantial proportion of our participants experienced depression, anxiety and a combination of both especially in those who had the risk factors we identified. The findings underscore the need to address modifiable risk factors for psychiatric manifestations early in the course of the disease and integrate mental health interventions and psychosocial support into COVID-19 management guidelines.

## Strengths and limitations of this study

- ⇒ The study was a multicentre study conducted in all the Edo State-designated treatment and isolation centres.
- ⇒ The study conducted over 30 weeks had a considerably large sample size which is generalisable to Edo State, Nigeria.
- ⇒ The cross-sectional design of the study did not permit causal inferences.
- ⇒ The absence of control group minimised our ability to estimate the true impact of COVID-19 on the mental health of our participants.

## INTRODUCTION

In recent times, the world has been challenged with a new coronavirus disease, which has demonstrated startling levels of spread, severity and fatality all over the globe.<sup>1</sup> As part of the WHO response, the virus was named COVID-19 and declared a pandemic.<sup>2</sup> Nigeria reported and hospitalised its first case of COVID-19 on 27 February 2020 and has since then witnessed a steady increase in the number of cases and associated deaths.<sup>3</sup> Expectedly, diverse reactions to this situation have ensued, with most persons predominantly experiencing feelings of anxiety and depression about a disease of this nature and its possible outcomes.<sup>4</sup> The existing literature on the mental health consequences of the pandemics both on the general population and persons with confirmed COVID-19 shows that depression, anxiety and other mental health problems are common.<sup>5–7</sup> These mental health consequences are predictable in both the short and long term.<sup>8</sup> The SARS

outbreak, for instance, was accompanied by significant psychiatric manifestations in both patients and health-care providers.<sup>9</sup>

Precisely, persons who test positive for COVID-19 or are suspected to have COVID-19 infection are especially vulnerable to psychological distress and mental illnesses.<sup>8 10</sup> Such persons may experience fear of the possible outcomes considering the potentially fatal nature of the infection. Also, staying in an isolation ward may trigger a wide range of emotions, which may include feelings of frustration, despair, hopelessness, stigma/humiliation, fear, anger and so on. Furthermore, research has demonstrated that the presence of high concentrations of inflammatory mediators above the physiologically relevant range may trigger mental disorders.<sup>11</sup>

The literature establishes a fundamental link between mental health and physical health. Poor physical health can lead to an increased risk of having mental health problems, conversely, poor mental health can negatively impact physical health, leading to an increased risk of some medical conditions.<sup>12 13</sup> Consequently, the coexistence of psychological and other medical conditions can result in increased distress, longer illness duration, poorer health outcomes and an increased cost/burden on the already scarce health resources and healthcare system.<sup>8 12 13</sup>

There is a dearth of literature on the psychiatric manifestations among hospitalised persons with COVID-19 infection in Africa including Nigeria, the most populous nation in Africa.<sup>14</sup> To the best of our knowledge, there is only one study in Nigeria that has reported the psychosocial health effects of COVID-19 infection on patients in treatment centres since the onset of the pandemic.<sup>6</sup> More studies are needed to understand the mental health sequelae of COVID-19 especially among hospitalised and isolated patients with the disease. This will inform policy and strategies to prevent and manage the mental health impact of the disease. This study aimed to determine the prevalence of depression and anxiety, as well as associated risk factors among patients with COVID-19 hospitalised at the Edo State government-designated treatment and isolation centres over 30 weeks.

## METHODS

### Setting and study design

A descriptive cross-sectional study was conducted from 15 April to 11 November 2020. The participants were COVID-19 real time-reverse transcriptase-PCR (rRT-PCR)-positive persons who were hospitalised at the three government-designated treatment and isolation centres in Edo State, Nigeria. All three centres were government funded.

### Patient and public involvement

Patients and the public were not involved in the design, conduct, reporting or dissemination plans of our research.

## Participants and data collection procedure

All eligible and consenting persons who were COVID-19 rRT-PCR positive and hospitalised at any of the study institutions within the period of the survey were recruited. The inclusion criteria comprised of persons with confirmed COVID-19, hospitalised at any of the study institutions who consented to participate in the study, and were aged 11 years and above. Exclusion criteria comprised of hospitalised persons who tested positive for COVID-19 but declined or were unable to give consent to participate in the study and persons below 11 years due to the inappropriateness of the assessment tools for anxiety and depression in this age group. Medical records/registers at the treatment and isolation centres were reviewed daily in order to identify new admissions and discharges in the centres and ineligible patients due to age (less than 11 years). A total of 796 persons with confirmed COVID-19 were hospitalised at the three government-designated treatment and isolation centres in Edo State over the study period. All patients were informed and acknowledged a detailed description of the study, eligibility requirements and voluntariness to participate in the study. Nineteen of them were below 11 years and were excluded, and 265 patients either refused to give consent or were too ill (critically ill) to consent and participate in the study. A total of 512 were therefore recruited for the study. Semistructured and structured questionnaires incorporating socio-demographics, basic clinical history/information, and an assessment of anxiety and depression were administered to recruited participants on the fifth day of admission into the treatment and isolation centres. The questionnaires were self-administered except for those who opted for interviewer-administered questionnaires (mainly those with severe COVID-19 infection). Questionnaires were administered in the English language as all participants had some levels of formal education and were literate enough to understand the language. Those who were critically ill with COVID-19 infection were unable to consent and participate in the study. Online survey and hard copies of the questionnaires were made available for completion. All the participants preferred hard copies of the questionnaires and a copy of the signed consent form was retained by each participant and one by the researchers. Clinical information on severity of COVID-19 infection and presence and type of comorbidity were obtained from their medical records (case files). Length of stay in treatment and isolation centres was obtained from their case files after discharge from the centres as the questionnaires were coded for ease of identification.

## Measurements

### The sociodemographic/clinical history questionnaire

This was designed to provide information about the participant's age, gender, religion, marital status, employment status and the highest level of formal education. Clinical variables such as COVID-19 rRT-PCR status, personal/family history of mental illness, the severity of COVID-19 infection, the number of days in isolation and

comorbidity were ascertained as well. To ascertain the worry factor, the question ‘what is your greatest worry about being COVID-19 positive’ was asked.

#### The nine-item Patient Health Questionnaire

This consists of nine items, each of which is scored 0–3, providing a 0–27 severity score.<sup>15</sup> The nine-item Patient Health Questionnaire (PHQ-9) severity is calculated by assigning scores of 0, 1, 2 and 3, to the response categories of: not at all, several days, more than half the days and nearly every day, respectively. It consists of the nine criteria for depression from the Diagnostic and Statistical Manual of Mental Disorders, fourth edition. The PHQ-9 is comparable or superior in operating characteristics, and valid as both a diagnostic and severity measure.<sup>16</sup> Scores of 5, 10, 15 and 20 represent cut-off points for mild, moderate, moderately severe and severe depression, respectively. A PHQ-9 score of 10 or greater is recommended if a single screening cut-off is to be used; this cut-off point has a sensitivity for major depression of 88% and a specificity of 88%. The modified version for adolescents (PHQ-A) was used for participants within the ages of 11 and 17 years. A cut-off score of  $\geq 10$  was used to represent cases of depression. The PHQ-9 can be self-administered or clinician administered.

#### The Generalized Anxiety Disorder-7

This is a seven-item self-report questionnaire that allows for the rapid detection of generalised anxiety disorder (GAD); the validity is not compromised if the clinician reads the questions to the client.<sup>17</sup> Participants are asked if they were bothered by anxiety-related problems over the past 2 weeks by answering seven items on a 4-point scale. The total scores range from 0 to 21. At a cut-off score of 10, the Generalized Anxiety Disorder-7 (GAD-7) had a sensitivity of 89% and a specificity of 82% for detecting GAD compared with a structured psychiatric interview.<sup>17</sup> Notably, among clinical and general population samples, the GAD-7 has demonstrated good reliability and cross-cultural validity as a measure of GAD.<sup>16</sup> Its use has been validated in adolescents.<sup>18</sup> A cut-off score of  $\geq 10$  was used to represent cases of anxiety.

#### Statistical analysis

The collected data were analysed using the SPSS V.21. Dependent variables were depression and anxiety. Independent variables were sociodemographic and clinical characteristics. Descriptive statistics were used to summarise sociodemographic and clinical-related data and mean with SD for continuous variables.  $\chi^2$  tests were used to test the association of independent variables with dependent variables. Fisher’s exact test was used for cells with expected frequencies ( $< 5$ ). The Student’s t-test was used to compare means. Binary logistic regression was applied to identify predictors of depression and anxiety that were significant at bivariate analysis. All tests were two tailed, and the level of significance was set at a p value of  $< 0.05$ .

## RESULTS

### Demographics and clinical characteristics

A total of 512 patients participated in the study over the survey period giving a response rate of 64.3%. Twenty-three questionnaires were excluded from analysis due to inconsistencies and incomplete responses, giving a total sample of 489. The mean age of participants was 43.39 (SD=16.94) years. Most of the participants were Christians (80.8%), married (59.3%), and slightly more than half had tertiary education (50.7%) and were employed (51.5%). Two hundred and ninety-eight (60.9%) patients had mild COVID-19 symptoms while 191 (39.1%) had moderate to severe symptoms. Of the 191 patients who had moderate to severe symptoms, 106 (55.5%) were male patients while 85 (45.5) were female patients. One hundred and seventy patients (34.8%) had comorbidity. Of the 170 (34.8) patients who had comorbidity, 69 (40.6%) had hypertension only, 33 (19.4%) had diabetes only, 31 (18.2%) had coexisting hypertension and diabetes, 9 (5.3%) were asthmatic, 3 (1.8%) had cancers and 26 (15.3%) had other illnesses. Twelve patients (2.5%) reported a history of mental illness and 12 (2.5%) also reported a family history of mental illness. Most of the patients (370; 75.7%) stayed less than 14 days in isolation while 119 (24.3%) stayed 14 or more days in isolation. Demographics and clinical characteristics of participants are reported in [table 1](#).

### Prevalence of depression and anxiety

About half of the patients (240; 49.1%) had mild to severe depressive symptoms, 161 (32.9%) had mild symptoms, 62 (12.7) had moderate symptoms, 12 (2.5%) had moderately severe and 5 (1.0%) had severe symptoms of depression. More than one-third of the patients (186; 38.0%) had mild to severe anxiety symptoms, 124 (25.4%) had mild symptoms, 47 (9.6) had moderate symptoms and 15 (3.1%) had severe symptoms of anxiety. Seventy-nine (16.2%) patients were classified as cases of depression while 63 (12.9%) patients were classified as cases of anxiety and 44 (9.0%) as cases of anxiety comorbid with depression. Prevalence of depression and anxiety is reported in [table 2](#).

### Worry factors

Ninety (18.4%) patients reported no worry about being COVID-19 positive. The most frequent worry factor expressed was worrying about the outcome of illness (195; 39.9%). Worry factors are reported in [figure 1](#).

### Risk factors associated with depression and anxiety

Using bivariate analysis, being separated/widowed ( $\chi^2=10.943$ ,  $p=0.012$ ), having moderate to severe COVID-19 symptoms ( $\chi^2=5.302$ ,  $p=0.021$ ), staying in isolation for 14 days or more ( $\chi^2=11.368$ ,  $p=0.001$ ) and having outcome of illness as worry factor (18.056,  $p=0.002$ ) were found to be significantly associated with cases of depression. Having moderate to severe COVID-19 symptoms ( $\chi^2=5.302$ ,  $p=0.021$ ), staying in isolation for 14 days or

**Table 1** Demographic and clinical characteristics of hospitalised patients with COVID-19 in Edo State, Nigeria

| Variable                           | Frequency (%)<br>n=489 | T-test | P value |
|------------------------------------|------------------------|--------|---------|
| <b>Age group (years)</b>           |                        |        |         |
| ≤24                                | 61 (12.5)              |        |         |
| 25–34                              | 102 (20.9)             |        |         |
| 35–44                              | 130 (26.6)             |        |         |
| 45–54                              | 78 (16.0)              |        |         |
| 55–64                              | 51 (10.4)              |        |         |
| ≥65                                | 67 (13.7)              |        |         |
| <b>Mean age (SD)</b>               |                        |        |         |
| Male                               | 45.6 (17.46)           | 3.000  | 0.003   |
| Female                             | 41.0 (16.06)           |        |         |
| <b>Sex</b>                         |                        |        |         |
| Male                               | 252 (51.5)             |        |         |
| Female                             | 237 (48.5)             |        |         |
| <b>Religion</b>                    |                        |        |         |
| Christianity                       | 395 (80.8)             |        |         |
| Islam                              | 85 (17.4)              |        |         |
| Traditional African religion       | 7 (1.4)                |        |         |
| Others                             | 2 (0.4)                |        |         |
| <b>Marital status</b>              |                        |        |         |
| Single                             | 131 (26.8)             |        |         |
| Married                            | 290 (59.3)             |        |         |
| Separated/divorced                 | 29 (5.9)               |        |         |
| Widowed                            | 39 (8.0)               |        |         |
| <b>Educational attainment</b>      |                        |        |         |
| Primary                            | 60 (12.3)              |        |         |
| Secondary                          | 166 (33.9)             |        |         |
| Tertiary                           | 248 (50.7)             |        |         |
| Others                             | 15 (3.1)               |        |         |
| <b>Employment status</b>           |                        |        |         |
| Employed                           | 252 (51.5)             |        |         |
| Not employed                       | 237 (48.5)             |        |         |
| <b>Severity of COVID-19</b>        |                        |        |         |
| Mild                               | 298 (60.9)             |        |         |
| Moderate-severe                    | 191 (39.1)             |        |         |
| <b>Comorbidity</b>                 |                        |        |         |
| Yes                                | 170 (34.8)             |        |         |
| No                                 | 319 (65.2)             |        |         |
| <b>Length of stay in isolation</b> |                        |        |         |
| <14 days                           | 370 (75.5)             |        |         |
| ≥14 days                           | 119 (24.3)             |        |         |
| <b>Past mental illness</b>         |                        |        |         |
| Yes                                | 12 (2.5)               |        |         |

Continued

**Table 1** Continued

| Variable                                | Frequency (%)<br>n=489 | T-test | P value |
|---|------------------------|--------|---------|
| No                                      | 477 (97.5)             |        |         |
| <b>Family history of mental illness</b> |                        |        |         |
| Yes                                     | 12 (2.5)               |        |         |
| No                                      | 477 (97.5)             |        |         |

more ( $\chi^2=11.368$ ,  $p=0.001$ ), having outcome of illness as worry factor (18.056,  $p=0.002$ ) and having comorbidity were found to be significantly associated with cases of anxiety. Analysis of factors associated with depression and anxiety is shown in [table 3](#).

### Predictors of depression and anxiety

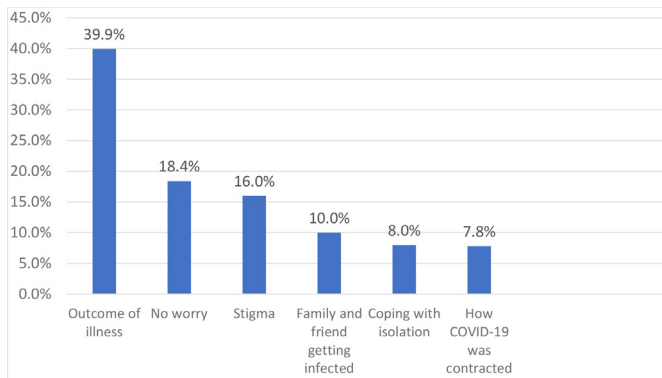
We conducted a binary logistic regression analysis to measure the correlations between dependent and independent variables that were significant at bivariate analysis. The unadjusted ORs are displayed in [table 4](#).

Analysis for adjusted ORs (AORs) was conducted to control for confounders. The model explained 14.1% (Nagelkerke  $R^2$ ) of the variance in depression and correctly classified 83.6% of cases. Being separated/divorced (AOR=3.98,  $p=0.002$ , 95% CI=1.655 to 9.583) compared with being married, staying 14 days or longer in isolation (AOR=2.31,  $p=0.002$ , 95% CI=1.352 to 3.946) compared with staying less than 14 days, and worrying about the outcome of COVID-19 infection (AOR=4.98,  $p=0.002$ , 95% CI=1.833 to 13.506) compared with no worry

**Table 2** Prevalence of depression and anxiety among hospitalised patients with COVID-19 in Edo State, Nigeria

| Variable                               | Frequency (%)<br>n=489 |
|--|------------------------|
| <b>Severity of depressive symptoms</b> |                        |
| None                                   | 249 (50.9)             |
| Mild                                   | 161 (32.9)             |
| Moderate                               | 62 (12.7)              |
| Moderately severe                      | 12 (2.5)               |
| Severe                                 | 5 (1.0)                |
| <b>Severity of anxiety symptoms</b>    |                        |
| None                                   | 303 (62.0)             |
| Mild                                   | 124 (25.4)             |
| Moderate                               | 47 (9.6)               |
| Severe                                 | 15 (3.1)               |
| Prevalence of depression*              | 79 (16.2)              |
| Prevalence of anxiety*                 | 63 (12.9)              |
| Depression comorbid with anxiety       | 44 (9.0)               |

\*Total score  $\geq 10$  in PHQ-9 and GAD-7 was considered to define the presence of depression and anxiety, respectively. GAD-7, Generalized Anxiety Disorder-7; PHQ-9, nine-item Patient Health Questionnaire.



**Figure 1** Worry factors expressed by hospitalised patients with COVID-19 in Edo State, Nigeria.

significantly increased the odds of having depression. For anxiety, the logistic model explained 8.2% (Nagelkerke  $R^2$ ) of the variance and correctly classified 87.1% of cases. Only worrying about the outcome of COVID-19 infection (AOR=3.23,  $p=0.023$ , 95% CI=1.176 to 8.155) significantly increased the odds of cases of anxiety after controlling for confounding variables.

## DISCUSSION

We present the estimates of depression and anxiety and associated risk factors from a cross-sectional cohort of hospitalised patients with confirmed COVID-19 in the three treatment and isolation centres in Edo State, Nigeria. Our study shows that male patients were slightly more than female patients. Fadipe *et al* also found a preponderance of male patients in confirmed COVID-19 cases.<sup>6</sup> The disparity between males and females may be attributed to inequalities in health-seeking behaviour. Males may access healthcare facilities and testing more than females.<sup>19</sup> However, Peckham *et al* had demonstrated no significant difference in the proportion of males and females with confirmed COVID-19 infection in a meta-analysis of over 3 million reported global cases.<sup>20</sup> Notably, our finding that moderate-severe form of COVID-19 infection was more in males than females was supported by Peckham *et al* in his meta-analysis where he demonstrated that male patients had significant higher odds of intensive care unit admissions and deaths than female patients and concluded that males and females were at equivalent risk of COVID-19 infection and male sex was associated with the development of severe disease.<sup>20</sup> This increased severity may be why males present more than females to health facilities for testing and treatment.

We found high rates of symptoms of depression and anxiety in patients with COVID-19 in treatment and isolation centres. About half (49.1%) and more than one-third (38.0%) of the patients had symptoms of depression and anxiety, respectively. Similarly, high rates of depressive and anxiety symptoms were reported by Paz *et al* in Ecuador and Zhang *et al* in China in patients with COVID-19.<sup>7 21</sup> As the pandemic spreads rapidly around the world

with devastating effects, it is expected that an increasing number of persons would experience anxiety, depression and other mental health problems especially in the context of a confirmed infection. This is made worse by the inappropriate risk communication and misinformation on social media.<sup>5</sup> Although in this study, apparent lower prevalence rates were recorded for patients classified as cases of depression (16.2%), anxiety (12.7%) and a combination of both (9.0%) when compared with the proportion having symptoms, these rates are higher than the prevalence rates of depression (5.5%), anxiety (3.5%) and anxiety comorbid with depression (1.2%) reported in the general population in the pre-COVID-19 pandemic era in Lagos, Nigeria.<sup>22</sup> A similar study in patients with COVID-19 in treatment centres in Lagos, Nigeria reported higher rates for probable cases of depression (28.10%), anxiety (27.50%) and a combination of both (15.60%).<sup>6</sup> However, the study conducted in Lagos, Nigeria had a smaller number of participants compared with ours (160 vs 489) and was conducted early in the first wave of the pandemic which coincided with peaks in COVID-19 deaths. Additionally, Lagos is the epicentre with the highest number of deaths from the pandemic in Nigeria.<sup>3</sup> These factors may be responsible for the higher rates of depression and anxiety they reported. On the other hand, we found higher rates of cases of depression and anxiety than those reported in recovered patients with COVID-19 in Tehran, Iran.<sup>23</sup>

The high rates of depressive and anxiety symptoms found in this study suggest that a substantial proportion of hospitalised patients with COVID-19 suffer the additional distress of concurrent mental health symptoms/conditions. While the development of depression and anxiety may partly result from the psychosocial consequences of COVID-19, they may also be induced by direct neurological injury through hypoxic damage and neuroinvasion.<sup>24</sup> COVID-19 has been described as a cytokine release syndrome with increased serum concentrations of interleukin-6 and other inflammatory cytokines which have been associated with psychiatric manifestations.<sup>11 24</sup> These manifestations may not only persist beyond the pandemic but may lead to increased illness, prolonged stay in the hospital, poorer health outcomes and avoidable strain on healthcare systems and scarce resources if not recognised and managed promptly.<sup>12 13</sup> Okogbenin *et al* in a retrospective analysis of psychiatric consultations in patients with Lassa fever infection concluded that mental health intervention could improve overall outcomes of Lassa fever disease.<sup>25</sup> Also, Okogbenin and Seb-Akahomen had recommended mental health and psychosocial intervention via telemental health services as a useful alternative to face-to-face intervention, a model they reported helped ameliorate the mental health effects of COVID-19 infection in patients at the Irrua Specialist Teaching Hospital's treatment and isolation centre in Nigeria.<sup>26</sup> Apparently, deliberate efforts are needed to address the mental health and psychosocial effects of COVID-19 in persons with the disease.

**Table 3** Association of demographic and clinical characteristics with depression and anxiety among hospitalised patients with COVID-19 in Edo State, Nigeria

| Variables                               | Depression |            |                     | Anxiety   |            |                     |
|---|------------|------------|---------------------|-----------|------------|---------------------|
|   | Cases      | Non-cases  | $\chi^2$<br>P value | Cases     | Non-cases  | $\chi^2$<br>P value |
| <b>Age group (years)</b>                |            |            |                     |           |            |                     |
| ≤24                                     | 5 (8.2)    | 56 (91.8)  | 6.397<br>0.270      | 4 (6.6)   | 57 (93.4)  | 8.573<br>0.121      |
| 25–34                                   | 17 (16.7)  | 85 (83.3)  |                     | 14 (13.7) | 88 (86.3)  |                     |
| 35–44                                   | 20 (15.4)  | 110 (84.6) |                     | 14 (10.8) | 116 (89.2) |                     |
| 45–54                                   | 12 (15.4)  | 66 (84.6)  |                     | 8 (10.3)  | 70 (89.7)  |                     |
| 55–64                                   | 13 (25.5)  | 38 (74.5)  |                     | 12 (23.5) | 39 (76.5)  |                     |
| ≥65                                     | 12 (17.9)  | 55 (81.1)  |                     | 11 (16.4) | 56 (83.6)  |                     |
| <b>Sex</b>                              |            |            |                     |           |            |                     |
| Male                                    | 42 (16.7)  | 210 (83.3) | 0.100<br>0.752      | 30 (11.9) | 222 (88.1) | 0.444<br>0.505      |
| Female                                  | 37 (15.6)  | 200 (84.4) |                     | 33 (13.9) | 204 (86.1) |                     |
| <b>Religion</b>                         |            |            |                     |           |            |                     |
| Christianity                            | 68 (17.2)  | 327 (82.8) | 1.694<br>0.599      | 51 (12.9) | 344 (87.1) | 2.137<br>0.518      |
| Islam                                   | 10 (11.8)  | 7 (88.2)   |                     | 10 (11.8) | 75 (88.2)  |                     |
| Traditional African religion            | 1 (14.3)   | 6 (85.7)   |                     | 2 (28.6)  | 5 (71.4)   |                     |
| Others                                  | 0 (0.0)    | 2 (100.0)  |                     | 0 (0.0)   | 2 (100.0)  |                     |
| <b>Marital status</b>                   |            |            |                     |           |            |                     |
| Single                                  | 19 (14.5)  | 112 (85.5) | 10.943<br>0.012*    | 16 (12.2) | 115 (87.8) | 1.890<br>0.600      |
| Married                                 | 44 (15.2)  | 246 (84.8) |                     | 37 (12.8) | 253 (87.2) |                     |
| Separated/divorced                      | 11 (37.9)  | 18 (62.1)  |                     | 6 (20.7)  | 23 (79.3)  |                     |
| Widowed                                 | 5 (12.8)   | 34 (87.2)  |                     | 4 (10.3)  | 35 (89.7)  |                     |
| <b>Educational attainment</b>           |            |            |                     |           |            |                     |
| Primary                                 | 8 (13.3)   | 52 (86.7)  | 0.877<br>0.835      | 7 (11.7)  | 53 (88.3)  | 2.976<br>0.389      |
| Secondary                               | 25 (15.1)  | 141 (84.9) |                     | 16 (9.6)  | 150 (90.4) |                     |
| Tertiary                                | 44 (17.7)  | 204 (82.3) |                     | 38 (15.3) | 210 (84.7) |                     |
| Others                                  | 2 (13.3)   | 13 (86.7)  |                     | 2 (13.3)  | 13 (86.7)  |                     |
| <b>Employment status</b>                |            |            |                     |           |            |                     |
| Employed                                | 28 (15.1)  | 214 (84.9) | 0.444<br>0.505      | 38 (15.1) | 214 (84.9) | 2.234<br>0.135      |
| Not employed                            | 41 (17.3)  | 196 (82.7) |                     | 25 (10.6) | 212 (89.4) |                     |
| <b>Severity of COVID-19</b>             |            |            |                     |           |            |                     |
| Mild                                    | 39 (13.1)  | 259 (86.9) | 5.302<br>0.021*     | 30 (10.1) | 268 (89.9) | 5.392<br>0.020*     |
| Moderate-severe                         | 40 (20.9)  | 151 (79.1) |                     | 33 (17.3) | 158 (82.7) |                     |
| <b>Comorbidity</b>                      |            |            |                     |           |            |                     |
| Yes                                     | 32 (18.8)  | 138 (81.2) | 1.370<br>0.242      | 30 (17.6) | 140 (82.4) | 5.269<br>0.022*     |
| No                                      | 47 (14.7)  | 272 (85.3) |                     | 33 (10.3) | 286 (89.7) |                     |
| <b>Length of stay in isolation</b>      |            |            |                     |           |            |                     |
| <14 days                                | 48 (13.0)  | 322 (87.0) | 11.368<br>0.001*    | 41 (11.1) | 329 (88.9) | 4.401<br>0.036*     |
| ≥14 days                                | 31 (26.1)  | 88 (73.9)  |                     | 22 (18.5) | 97 (81.5)  |                     |
| <b>Past mental illness</b>              |            |            |                     |           |            |                     |
| Yes                                     | 4 (5.1)    | 75 (94.9)  | 2.680<br>0.102      | 3 (4.8)   | 60 (95.2)  | 1.609<br>0.205      |
| No                                      | 8 (2.00)   | 402 (98.0) |                     | 9 (2.1)   | 417 (97.9) |                     |
| <b>Family history of mental illness</b> |            |            |                     |           |            |                     |
| Yes                                     | 3 (3.8)    | 76 (96.2)  | 0.710<br>0.421      | 1 (1.6)   | 62 (98.4)  | 0.663<br>0.227      |
| No                                      | 9 (2.2)    | 401 (97.8) |                     | 11 (2.6)  | 415 (97.4) |                     |

Continued

**Table 3** Continued

| Variables                    | Depression |            |                     | Anxiety   |            |                     |
|------------------------------|------------|------------|---------------------|-----------|------------|---------------------|
|                              | Cases      | Non-cases  | $\chi^2$<br>P value | Cases     | Non-cases  | $\chi^2$<br>P value |
| <b>Worry factors</b>         |            |            |                     |           |            |                     |
| No worry                     | 5 (5.6)    | 85 (94.4)  | 18.056<br>0.002*    | 5 (5.6)   | 85 (94.4)  | 15.460<br>0.009*    |
| Outcome of illness           | 46 (23.6)  | 149 (76.4) |                     | 37 (19.0) | 158 (81.0) |                     |
| Stigma                       | 13 (16.7)  | 65 (83.3)  |                     | 12 (16.7) | 60 (83.3)  |                     |
| Infesting family and friends | 6 (12.2)   | 43 (87.8)  |                     | 3 (6.1)   | 46 (93.9)  |                     |
| Coping with isolation        | 3 (7.7)    | 36 (92.3)  |                     | 2 (5.1)   | 37 (94.9)  |                     |
| How infection was contracted | 6 (15.8)   | 32 (94.2)  |                     | 4 (10.5)  | 34 (89.5)  |                     |
| *P <0.05.                    |            |            |                     |           |            |                     |

Being separated/divorced was a strong predictor of depression compared with being married in our study. This is in tandem with previous studies that reported a significant association between being separated/divorced and experiencing depression.<sup>22 27</sup> We note that depression and anxiety occurred most in patients aged 55 years and above and least in those who were 24 years or less. Similarly, Zhang *et al* and Kong *et al* in China reported that

older patients with COVID-19 were more likely to have depression and anxiety.<sup>21 28</sup> Older persons are generally more likely to have comorbidity that have been associated with a severe form of COVID-19.<sup>29</sup> In the analysis of the severity of COVID-19, we found that having moderate to severe symptoms significantly increased the risk of having depression and anxiety. This may occur for two reasons: first, they may have a more intense immune-inflammatory

**Table 4** Logistic regression (with unadjusted ORs) of demographic and clinical risk factors associated with depression and anxiety among hospitalised patients with COVID-19 in Edo State, Nigeria

| Variables                            | Depression |         |                 | Anxiety |         |                 |
|--------------------------------------|------------|---------|-----------------|---------|---------|-----------------|
|                                      | OR         | P value | 95% CI          | OR      | P value | 95% CI          |
| <b>Marital status</b>                |            |         |                 |         |         |                 |
| Married                              | 1 (ref)    |         |                 | —       |         |                 |
| Single                               | 0.95       | 0.859   | 0.530 to 1.698  | —       | —       | —               |
| Separated/divorced                   | 3.42       | 0.003*  | 1.511 to 7.725  | —       | —       | —               |
| Widowed                              | 0.82       | 0.699   | 0.305 to 2.217  | —       | —       | —               |
| <b>Severity of COVID-19</b>          |            |         |                 |         |         |                 |
| Mild                                 | 1 (ref)    |         |                 | 1 (ref) |         |                 |
| Moderate-severe                      | 1.76       | 0.022*  | 1.084 to 2.856  | 1.87    | 0.022*  | 1.096 to 3.176  |
| <b>Duration of stay in isolation</b> |            |         |                 |         |         |                 |
| <14 days                             | 1 (ref)    |         |                 | 1 (ref) |         |                 |
| ≥14 days                             | 2.36       | 0.001   | 1.420 to 3.933  | 1.82    | 0.038*  | 1.034 to 3.203  |
| <b>Worry factor</b>                  |            |         |                 |         |         |                 |
| No worry                             | 1 (ref)    |         |                 | 1 (ref) |         |                 |
| Outcome of illness                   | 5.25       | 0.001*  | 2.008 to 13.715 | 3.98    | 0.005*  | 1.509 to 10.506 |
| Stigma                               | 3.40       | 0.026*  | 1.154 to 10.020 | 3.09    | 0.043*  | 0.037 to 9.209  |
| Infesting family and friends         | 2.37       | 0.173   | 0.685 to 1.215  | 1.11    | 0.891   | 0.253 to 4.849  |
| Coping with isolation                | 1.42       | 0.645   | 0.321 to 6.245  | 0.92    | 0.922   | 0.170 to 4.953  |
| How COVID-19 was contracted          | 3.19       | 0.070   | 0.909 to 11.176 | 2.00    | 0.323   | 0.506 to 7.899  |
| <b>Comorbidity</b>                   |            |         |                 |         |         |                 |
| No                                   | —          | —       | —               | 1 (ref) |         |                 |
| Yes                                  | —          | —       | —               | 1.86    | 0.023   | 1.089 to 3.168  |
| *P <0.05.                            |            |         |                 |         |         |                 |



dysregulation;<sup>30</sup> and second, the awareness of the relationship between the severity of COVID-19 and its outcomes in these patients may precipitate depression and anxiety. This may also explain why patients with comorbidity had an increased risk of anxiety.

Staying 14 days or longer in isolation was significantly associated with increased risk of depression and anxiety. This compares with other studies that have linked social isolation during the pandemics with depression, anxiety and other mental health disorders.<sup>29 30</sup> Loss of functionality and social interaction, limited physical activities, suffering without the support of loved ones, and watching others suffer or even die are possible contributory factors that may precipitate mental health problems in COVID-19 treatment and isolation centres. Conversely, the presence of depression and/or anxiety could be a possible reason for a prolonged stay in isolation. Also, we found that most of our participants (81.6%) expressed varying worry factors. In addition, worrying about the outcome of the infection was the strongest predictor for depression and anxiety even after adjusting for covariance. Other studies have reported similar findings.<sup>5 6</sup> This is not unexpected considering the potential of the disease to cause a severe illness and have a fatal outcome. Worrying about stigma also increased the risk of having depression and anxiety. Fadipe *et al* reported similar concerns in a comparable cohort in Lagos.<sup>6</sup> The general stringent preventive measures including the heavy use of personal protective equipment by COVID-19 frontline health professionals to prevent transmission of the virus may promote discrimination and stigma including self-stigma. It is therefore quite understandable for hospitalised and isolated persons with COVID-19 to be worried about stigma.

### Strengths and limitations of this study

As far as we know, this is the second study exploring psychiatric manifestations and psychosocial effects in hospitalised patients with COVID-19 in Nigeria, the most populous country in Africa. The study identified important risk factors. Also, we conducted a multi-centre study that collected samples over 30 weeks in the ongoing pandemic; this increased our sample size compared with the previous study, giving more room for generalisation of findings. Our study had some limitations. First, we did not have a control group, thus, this minimised our ability to estimate the true impact of COVID-19 on the mental health of our participants; second, our study had a cross-sectional design and so could not permit causal inferences; and third, a structured diagnostic interview was not used to confirm our cases of depression and anxiety.

In conclusion, we report that a considerable proportion of hospitalised patients with COVID-19 in Edo State, Nigeria had depression, anxiety and a combination of both. Risk factors identified especially the

modifiable ones should be monitored and addressed promptly when managing patients with COVID-19. Mental health interventions and psychosocial support need to be integrated into COVID-19 management guidelines to ensure holistic care and ameliorate the mental health effects of the disease. Prospective and control studies are recommended to determine the true mental health impact of COVID-19 on persons with the disease.

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