# A longitudinal study result comparing Anxiety and Depression in hospitalized COVID-19 and non-COVID-19 patients in Mongolia

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**Abstract:** 1) Background: The COVID-19 pandemic has significantly impacted global health, particularly affecting the mental well-being of hospitalized patients. This longitudinal study aimed to compare levels of anxiety and depression between hospitalized patients with COVID-19 and those hospitalized for other conditions in Mongolia. 2) Methods: Utilizing a mixed-methods design, 552 patients were assessed, including 339 with COVID-19 and 153 with non-COVID-19 conditions. Mental health was evaluated using the Patient Health Questionnaire-9 (PHQ-9) for depression and the Generalized Anxiety Disorder 7-item scale (GAD-7) for anxiety. 3) Results: Results indicated that 58.4% of the COVID-19 group and 47.7% of the non-COVID-19 group exhibited signs of depression, while 48.9% and 35.9%, respectively, met criteria for anxiety, with significant differences (p=0.024 and p=0.006). Follow-up assessments at three- and twelve-months post-discharge showed higher rates of depression (57.3% at three months) and anxiety (46.9% at three months) in the COVID-19 group compared to their counterparts. Multivariable logistic regression analysis revealed that the COVID-19 group had a 1.5-fold increased risk of depression and a 1.7-fold increased risk of anxiety, even after adjusting for age, sex, marital status, employment, and household conditions. 4) Conclusions: The findings confirm that COVID-19 significantly increases depression and anxiety among hospitalized patients. Notably, both short-term and long-term follow-ups revealed that depression and anxiety were highly prevalent in the COVID-19 group. These results highlight the urgent need for targeted interventions to improve the mental health of affected individuals.

**Keywords:** anxiety; depression; COVID-19

## 1.0 INTRODUCTION

The COVID-19 pandemic has had a profound impact on global health, notably affecting mental health among hospitalized patients. Emerging data indicate a significant increase in anxiety and depression symptoms among individuals infected with the virus, often exacerbated by isolation, uncertainty, and fear of severe illness (Torales et al., 2020; Wang et al., 2020). COVID-19 can have sequelae lasting for months after initial recovery (Hennemann et al., 2024), including neurological (Dong et al., 2024) and psychiatric (Bellan et al., 2021). Moreover, few studies have included a control group (Vergori et al., 2024), which would facilitate differentiating direct effects of the disease and indirect factors of the pandemic. Persisting mental distress may appear also among patients with mild COVID-19 (A Carvalho et al., 2024). Besides infection-related factors, other mechanisms such as education, age, and psychological factors including distress may modulate cognitive outcomes (Majoka and Schimming, 2021). COVID-19 survivors may experience mental distress, including symptoms of depression and post-traumatic stress disorder (PTSD) (Heesakkers et al., 2022).

In Mongolia, the healthcare system has faced unprecedented stresses due to COVID-19, prompting an urgent need to understand how this virus affects mental health. Previous studies have documented mental health issues among different patient populations; however, there is a scarcity of research focused specifically on hospitalized patients with COVID-19 in Mongolia (Nemeth et al., 2021). Comparative studies have suggested that those hospitalized with COVID-19 display higher levels of anxiety and depression than their non-COVID-19 counterparts, pointing to the potential role of disease severity and physiological stressors (Gonzalez-Sanguino et al., 2020; Chevance et al., 2020). The objective of this longitudinal study is to compare anxiety and depression between hospitalized patients with COVID-19 and those hospitalized for other conditions in Mongolia. This research aims to provide insights into the mental health ramifications of COVID-19 and identify potential differences in psychological outcomes, thus informing clinicians and policymakers on how to better support mental health in both patient groups.

## 2.0 MATERIALS AND METHODS

### 2.1 Study design, setting, and population

A prospective longitudinal mixed-methods study was conducted with a cohort of patients across three centers: Mongolia-Japan Hospital, Central Hospital, and the Central Hospital of Mongolian Medicine at the Mongolian National University of Medical Sciences (MNUMS). The study protocol was approved by the Ethics Committee of MNUMS (№2021/3-08). All participants provided written informed consent, and the principles of the Declaration of Helsinki were followed.

Initially, patients were assessed in two groups: those with COVID-19 and those with non-COVID-19 conditions. Follow-up assessments were conducted longitudinally at three and twelve months after hospital discharge. We included patients who had available data for the study outcomes, resulting in a final baseline sample of 522 patients: 399 who were treated for COVID-19 and 153 who were hospitalized for non-COVID-19 reasons. All patients were hospitalized or tested positive for COVID-19 between June and October 2021. Follow-up recruitment occurred through phone invitations after discharge, concluding in October 2022.

Inclusion criteria for the study consisted of PCR or antibody testing, being 18 years or older, and fluency in written and spoken Mongolian. Exclusion criteria included pregnancy, a prior major neuropsychiatric diagnosis, being illiterate, and death during hospitalization (Figure 1)

*Figure 1 is here*

### 2.2 Study outcome

Socio-demographic data were collected using self-report questionnaires. The presence of psychiatric conditions, depression, and anxiety was evaluated with the structured psychiatric interview, the Mongolian versions of the Patient Health Questionnaire-9 (PHQ-9) and the Generalized Anxiety Disorder 7-item scale (GAD-7), respectively.

PHQ-9 is a widely used tool for assessing the severity of depression. It consists of nine questions that directly correspond to the diagnostic criteria for major depressive disorder in the Diagnostic and Statistical Manual of Mental Disorders (DSM-5), and the standard cutoff score for screening to identify possible major depression is 10 or above (Kroenke et al., 2001). In this study, Cronbach's alpha was 0.88.

GAD-7 is a widely used screening tool designed to assess the severity of generalized anxiety disorder (GAD) symptoms, that includes seven items, each addressing the core symptoms of GAD, such as excessive worry, difficulty controlling worry, restlessness, fatigue, difficulty concentrating, irritability, and sleep disturbances. Respondents rate the frequency of these symptoms over the past two weeks on a scale from 0 (not at all) to 3

(nearly every day). The total score can range from 0 to 21, with higher scores indicating greater anxiety severity. The GAD-7 has been validated for use in various populations and exhibited good psychometric properties, making it a reliable tool for screening anxiety in clinical settings and research. Its brief nature allows for easy administration, which is particularly beneficial in high-stress environments such as hospitals, where rapid assessment is vital for timely intervention (Spitzer et al., 2006). In our sample GAD-7 demonstrated high internal consistency with 0.91.

**2.3 Statistical analysis**

The results were analyzed using SPSS version 25.0. Pearson's Chi-square test was employed to assess differences between two independent variables. A p-value of less than 0.05 was considered statistically significant. To identify influencing risk factors, both univariate and multivariate binary logistic regression analyses were conducted to calculate the odds ratio, 95% confidence interval for the odds ratio, and corresponding p-value.

**3.0 RESULTS**

**3.1 Demographic characteristics of patients at the baseline study**

A total of 552 patients participated in the study, comprising 339 individuals in the COVID-19 group and 153 in the non-COVID-19 group. In terms of gender, 218 (39.5%) were men and 334 (60.5%) were women. Regarding age distribution, 109 (19.7%) were under 29 years old, 124 (22.5%) were aged 30 to 39 years, 119 (21.6%) were 40 to 49 years, 99 (17.9%) were 50 to 59 years, and 101 (18.3%) were over 60 years, resulting in a mean age of 43.9 ± 15.5 years (see Table 1).

*Table 1 is here*

**3.2 Comparison of Depression and Anxiety Across Different Follow-Up Time Points**

In the study, 58.4% of the COVID-19 group and 47.7% of the non-COVID-19 group exhibited signs of depression as indicated by the PHQ-9. Additionally, 48.9% of the COVID-19 group and 35.9% of the non-COVID-19 group met the criteria for anxiety as assessed by the GAD-7. The results indicated that the COVID-19 group was significantly more likely to experience depression (p=0.024) or anxiety (p=0.006) compared to the non-COVID group. Of the total 552 patients, 51.4% (n=284) participated in the three-month follow-up assessment, while only 35.3% (n=195) participated in the twelve-month assessment. Within the COVID-19 group, the participation rates were 46.1% (n=184) at three months and 24.1% (n=96) at twelve months. In contrast, the non-COVID-19 group maintained a higher participation rate of 64.7% at both follow-up time points.

Regarding depression rates, the COVID-19 group showed the following percentages: 42.4% at baseline, 57.3% at three-month follow-up, and 45.8% at twelve-month follow-up. In comparison, the non-COVID-19 group reported depression rates of 35.0% at baseline, 34.3% at three-month follow-up, and 20.2% at twelve-month follow-up. These results indicate that the COVID-19 group was more likely to experience depression over time.

For anxiety, the COVID-19 group's rates were 53.3% at baseline, 46.9% at three-month follow-up, and 37.5% at twelve-month follow-up. Conversely, the non-COVID-19 group reported anxiety rates of 26.0% at baseline, 25.3% at three-month follow-up, and 13.1% at twelve-month follow-up. These findings further demonstrate that the COVID-19 group was more likely to experience anxiety (see Table 2).

*Table 2 is here*

**3.3 Risk Factors Influencing Depression and Anxiety**

Multivariable logistic regression analysis indicated that the COVID-19 group was associated with a 1.5-fold higher risk of depression and a 1.7-fold higher risk of anxiety, even after adjusting for age, sex, marital status, employment, and household conditions. Other demographic variables were not significantly associated with depression or anxiety in either univariable or multivariable analyses (see Table 4).

*Table 3 is here*

**4.0 DISCUSSION**

This longitudinal study found that hospitalization for COVID-19 was associated with a higher prevalence of anxiety and depression compared to those hospitalized for non-COVID-19 conditions. Specifically, 58.4% of the COVID-19 group exhibited symptoms of depression, as measured by the PHQ-9, while 48.9% met the criteria for anxiety according to the GAD-7. In contrast, the non-COVID-19 group reported fewer mental health issues, with 47.7% experiencing depression and 35.9% experiencing anxiety.

Interestingly, our study found that the prevalence of depression and anxiety persisted over both short- and long-term follow-ups, with significant rates maintained at three- and twelve-months post-discharge. This suggests that the psychological effects of COVID-19 are not merely transient; they necessitate ongoing monitoring and intervention.

Additionally, a prior study focusing on chronically ill patients reported depression prevalence at 16.3% and anxiety at 17.9% (Mehari et al., 2023). In non-hospitalized COVID-19 patients, earlier research indicated lower rates of 3.6% for depression and 14.3% for anxiety (Lusida et al., 2022), underscoring the significantly higher prevalence found in our COVID-19 cohort. One-month follow-up studies revealed depression rates ranging from 20% to 31% and anxiety from 14% to 42% (Mazza et al., 2020; Wu et al., 2022). In longer-term six-month follow-up studies, depression varied between 22.8% and 46.3%, while anxiety fluctuated between 13.9% and 75.7% (Gad et al., 2023). These results align with our findings and suggest that cumulative stressors associated with COVID-19 recovery may continue to persist over time.

While our study design is robust, further research is warranted to refine the methodology and increase sample size. The absence of certain demographic and clinical variables may limit the generalizability of our findings.

In conclusion, our study highlights the urgent need for targeted mental health interventions aimed at hospitalized patients with COVID-19. Healthcare providers should implement integrated mental health services to identify and support patients experiencing psychological distress. Future research should explore the long-term effects of COVID-19 on mental health and evaluate the effectiveness of various intervention strategies to mitigate these impacts.

## 5.0 CONCLUSIONS

The findings confirm that COVID-19 significantly increases depression and anxiety among hospitalized patients. Notably, both short-term and long-term follow-ups revealed that depression and anxiety were highly prevalent in the COVID-19 group. These results highlight the urgent need for targeted interventions to improve the mental health of affected individuals.

**Supplementary Materials:**

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**Author Contributions:** E.R. and K.Z. conceived and designed the experiments; E.R., M.A., U.M., M.E., A.A., A.B. performed the experiments; Y.M. and E.T. analyzed the data; E.R. and K.Z contributed reagents/materials/analysis tools; E.T. and E.R. wrote the paper.

**Conflicts of Interest:** The authors declare no conflict of interest

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## TABLES

**Table 1.**

| Variables | | Total 552 (100%) |
|---|---|---|
| **Participant group** | COVID-19 | 339(70.5) |
| | Non-COVID-19 | 153(29.5) |
| **Age group, n (%)** | 18 - 29 | 109 (19.7) |
| | 30 - 39 | 124 (22.5) |
| | 40 - 49 | 119 (21.6) |
| | 50 - 59 | 99 (17.9) |
| | 60 or above | 101 (18.3) |
| **Sex, n (%)** | Female | 334 (60.5) |
| | Male | 218 (39.5) |
| **Marital Status, n (%)** | Married | 380 (68.8) |
| | Others[#] | 86(15.6) |
| | Never married | 86 (15.6) |
| **Education, n (%)** | Bachelor's degree or above | 271 (49.1) |
| | Below bachelor's degree | 281 (50.9) |
| **Employment, n (%)** | Unemployed | 214 (38.8) |
| | Employed | 338 (61.2) |
| **Household condition, n (%)** | Apartment | 373 (67.6) |
| | Ger horoolol | 179 (32.4) |

**Table 2.**

| Variables | Total | COVID-19 | non-COVID-19 | *P* value |
|---|---|---|---|---|
| *Baseline* | 552 (100%) | 399 (100%) | 153 (100%) | |
| Depression | 306 (55.4) | 233 (58.4) | 73 (47.7) | **0.024** |
| Anxiety | 250 (45.3) | 195 (48.9) | 55 (35.9) | **0.006** |
| *Follow-up (3 months)* | 284 (51.4) | 184 (46.1) | 100 (65.4) | |
| Depression | 133 (46.8) | 98 (53.3) | 35 (35) | **0.003** |
| Anxiety | 104 (36.6) | 78 (42.4) | 26 (26) | **0.006** |
| *Follow-up (12 months)* | 195 (35.3) | 96 (24.1) | 99 (64.7) | |
| Depression | 64 (32.8) | 44 (45.8) | 20 (20.2) | **<0.001** |
| Anxiety | 49 (25.1) | 36 (37.5) | 13 (13.1) | **<0.001** |

**Table 3.**

| Dependent variable | cOR [95% CI] | *P* value | aOR [95% CI] | *P* value |
|---|---|---|---|---|
| | *Depression* | | | |
| GOVID-19 | 1.538 [1.058 - 2.237] | **0.024** | 1.371 [0.887 - 2.17] | **0.155** |
| | *Anxiety* | | | |
| GOVID-19 | 1.703 [1.16 - 2.501] | **0.007** | 1.885 [1.209 - 2.939] | **0.005** |

Reference category – non-COVID-19 95%; CI - 95% confidence interval; cOR - Crude odds ratio; aOR - Adjusted odds ratio, adjusted by age, sex, marital status, employment, household condition.

## FIGURES (PUT ALL YOUR FIGURES HERE)

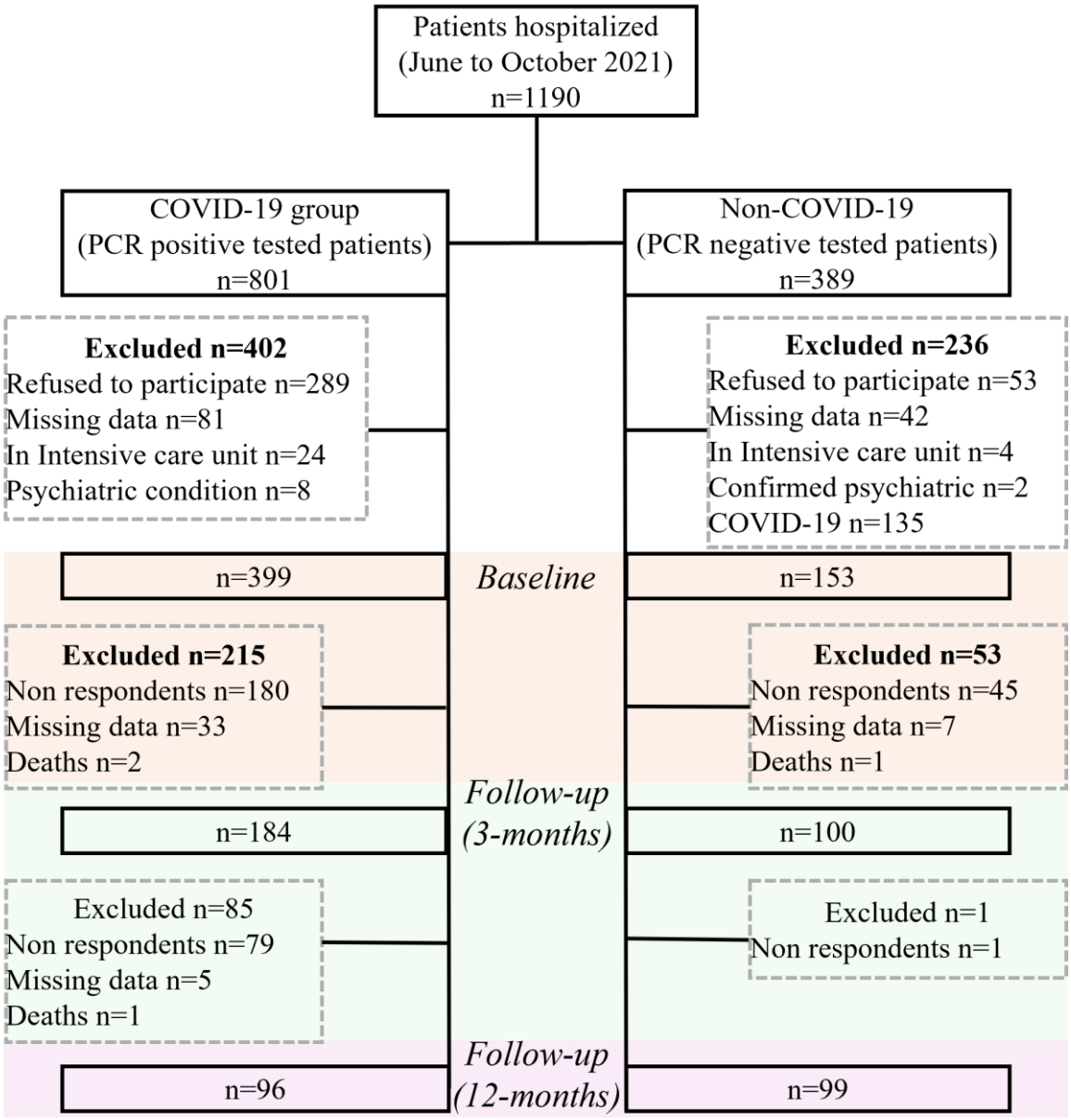


**Figure 1.** The flowchart shows that at baseline, there were 399 participants in the COVID-19 group and 153 in the non-COVID-19 group. During the 3-month follow-up, the COVID-19 group saw 215 exclusions due to 180 non-respondents, 32 missing data, and 3 deaths, leaving 184 participants. The non-COVID-19 group had 53 exclusions due to 45 non-respondents, 7 missing data, and 1 death, resulting in 100 participants. At the 12-month follow-up, the COVID-19 group included 96 participants and the non-COVID-19 group had 99 participants, accounting for further dropouts.