COVID-19 Mental Health Challenges: A Systematic Review, Logistic Regression and Principal Component Analysis

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Introduction

COVID-19 or SARS-COV2 is an infectious virus newly discovered in the coronavirus family. World Health Organization (WHO) declared COVID-19 (SARS-COV2) viral infection as Pandemic on January 31, 2020 [1]. The COVID-19 virus is mainly transmitted by coming in close proximity of a person who is COVID-19 positive. The virus spreads through droplets generated when a person coughs, sneezes, or exhales. To control the spread of viral infection around 4 billion i.e. half of the world population have been ordered by respective Governments to follow home confinement that is apparently the largest psychological experiment ever. Till date, Globally, there have been 4,904,413 confirmed cases of COVID-19, including 323,412 deaths, reported to WHO [1]. According to reported research during epidemic and/or deadly illnesses there are enormous mental pressure on affected population. Social distancing, isolation, and fear of COVID-19, inadequate PPEs are making people vulnerable to mental health problems specifically on patients and frontline medical staff [2,3]. During quarantine, home confinement and while carrying out essential health care duties it’s likely that one feels anxious, depressed and concurrently loses sleep [4]. Increased workload, physical exhaustion, inadequate and nosocomial transmission, fear of corona virus is supposed to elevate the most common emotion that is anxiety. Also, persons who had mental health history may face novel psychological challenges or their condition may worsen during Corona Quarantine. A dramatic decline in physical and mental well-being has also triggered some suicide cases related to COVID-19. Therefore, the Psychological support during COVID-19 Pandemic is vital towards enhancing resilience and good mental health. The aim this study is to carry out Review of COVID-19 related mental health issues among the affected population. We have compiled and evaluated data that gives evidence of psychological issues due to COVID in in order to analyse the prevalence of Anxiety, Depression and Insomnia among the affected population. The data analysis will help in crafting precautionary measures to mitigate the toxic mental health effects of COVID-19.

Abstract

Background: World Health Organization (WHO) declared COVID-19 (SARS-COV2) viral infection as Pandemic on January 31, 2020. The virus is a highly transmittable and pathogenic, displaying primary symptoms of elevated temperature, cough, headache and to some extent loss of taste or smell. However, there are imperceptible psychological effects that are difficult to assess and cure than relevant physical indicators. COVID-19 Positive patients and Medical staff are at high risk to get affected psychologically. Therefore, the mental health status is required to be monitored on priority basis. This study aims to review, synthesize, and analyze published evidence on the prevalence of anxiety, depression, and insomnia among patients, medical staff, and others (general population) during the COVID-19 outbreak.

Method: Based on PRISM Statement systematic search and review of published data till May 2020 on SARS-COV2 related psychological factor analysis was carried out. Logistic regression and PCA was performed to assess the prevalence of specific psychological aspects related to the prevailing COVID-19 pandemic.

Findings: The studies in included in the review, assessed anxiety, depression, distress, insomnia, and suicidal cases in relation to COVID-19. Participants reported psychological burden and high prevalence rates of depression, anxiety, and insomnia. The multiple linear regression analysis showed significance for anxiety (p<0.05). PCA reduced for critical Psych parameters into two components, PC1 with eigen value (E=2.67) and PC2 having eigen value (E=1.11).

Interpretation: COVID-19 patients, frontline medical staff, are at higher risk of mental health challenges.

Recommendation: The study recommends psychological prescription to COVID-19 patients, medical staff, and general population.
Material and Methods

Study design

The study design was Systematic Review of published researched articles, extraction of data based on inclusion and exclusion criterion set and result interpretation after statistical analysis. The methodical literature review and selection criteria to extract COVID-19 data was in accordance with the PRISMA statement depicted in Figure 1.

Data extraction

The psychological data of anxiety, depression, poor sleep, suicidal cases linked to the COVID-19 positive patients, Quarantine population, medical professionals and general population were extracted from published articles on PubMed, Google scholar, Research gate, ScienceDirect, MedRxiv sites [5-13]. Further the references from articles were used to increase data base. Only English Language articles were searched and retrieved. The few of the total reviewed journals are listed in Table 1.

Data synthesis and analysis

Microsoft Excel for Windows was utilized in the current study to synthesize and organise data. The data was arranged as Author, publication and year, sample population, evaluation test methods applied, sample size and sample characteristics, age and gender, statistical method applied for assessment, psychological parameters determined and result outcomes. Details are presented in Table 1. The primary psychological parameters retrieved were Anxiety, Depression, Insomnia, Distress (Figure 1).
Table 1: Review of literature on psychological distress related to Co-vid-19 pandemic.

| Year       | Publication | Author                       | Study Design                   | Subjects                                      | Parameters                                                                 | Evaluation Method                                      | Statistics                                                                 | Outcome                                                                 |
|------------|-------------|------------------------------|--------------------------------|-----------------------------------------------|---------------------------------------------------------------------------|--------------------------------------------------------|---------------------------------------------------------------------------|-------------------------------------------------------------------------|
| 24 Mar 2020| Online      | Xiangyu Kong et al. [5]      | Questionnaire Survey           | N=144 Hospitalized COVID-19 patients          | • Depression and anxiety symptoms                                          | Hospital Anxiety and Depression Scale (HADS)          | Multivariate linear regression analyses                                | • 34.7% Anxiety, 28.4% Depression                                    |
|            |             |                              |                                |                                               | • Social support                                                           | Perceived Social Support Scale (PSSS)                  | Bivariate correlation                                        | Less social support was correlated with more anxious (r=-0.196, p<0.05) and depressive (r=-0.360, p<0.05) symptoms |
| 31 Mar 2020| General Psychiatry Research | Jiang Du et al. [6]         | Smartphone-based survey         | N = 134 Medical Staff                       | • Psychological distress, Psychological preparedness                     | Perceived Stress Scale (PSS), Beck Depression Inventory-II (BDI-II), Beck Anxiety Inventory (BAI) | Logistic regression                                                      | Prevalence of moderate stress and elevated depressive (BDI-II scores ≥ 14) and anxiety symptoms (BAI scores ≥ 8): |
| 26 Mar 2020| Psychiatry Research | Yeen Huang et al. [7]        | Web-based cross-sectional       | N = 7,236 Medical Staff, Teachers and Others | • Generalized anxiety disorder (GAD), Depressive symptoms, Sleep quality | National Internet Survey on Emotional and Mental Health (NISEMH), Generalized Anxiety Disorder-7(GAD-7), Center for Epidemiology Scale for Depression (CES-D), PSQI (Pittsburgh Sleep Quality Index) | Chi-square test, Uni and multi logistic regression                   | High prevalence of GAD and poor sleep quality during COVID-19 outbreak |
| Date       | Journal                        | Authors                  | Study Design                          | Study Population | Measures                                                                 | Analysis                                                                 | Results/Findings                                                                 |
|-----------|--------------------------------|--------------------------|---------------------------------------|------------------|--------------------------------------------------------------------------|---------------------------------------------------------------------------|--------------------------------------------------------------------------------|
| 06 May 2020 | Brain, Behavior, and Immunity | Sofia Pappa et al. [8]   | Review                                | N=33062 Medical Staff | Anxiety, Depression, Insomnia, Pooled Prevalence | Zung Self-Rating Anxiety Scale (SAS), GAD-7, Zung Self-Rating Depression Scale (SDS), Patient Health Questionnaire 9-item depression module (PHQ-9) | High prevalence rates of depression, anxiety, and insomnia               |
| 23 Mar 2020 | JAMA Network Open             | Jianbo Lai et al. [9]    | Cross-sectional hospital-based survey | N=12,577 Medical Staff | Depression, Anxiety, Insomnia, And Distress, [factors associated with mental health outcomes] | PHQ-9, GAD-7, 7-item Insomnia Severity Index (ISI), 22-item Impact of Event Scale–Revised (IES-R) | Participants reported experiencing psychological burden, Frontline medical staff at higher risk of mental health symptoms   |
| 14 Apr 2020 | Frontiers in Psychiatry       | Chenxi Zhang et al. [10] | WeChat program Questionnaire          | N=1,563 Medical Staff + others | Insomnia, depressive, anxiety and stress-related symptoms | PHQ-9, GAD-7, ISI-7, IES-R-22 | Insomnia symptoms during the COVID-19 outbreak                           |
| 09 Apr 2020 | Psychiatry/Psychosom           | Wen-rui Zhang et al. [11]| Online survey                         | N=2,182           | insomnia, anxiety, depression, somatization, obsessive-compulsive symptoms, phobic anxiety | ISI-7, PHQ-4, GAD-2, Symptom Check List-90-revised (SCL-90-R) | During COVID-19 medical health workers had psychosocial problems and risk factors for developing them. |
| 16 Mar 2020 | Online                         | Zhou Zhu et al. [12]     | Online questionnaire survey           | N=5062            | Depressive, anxious and stress-related symptoms | PHQ-9, GAD-7, ISI-7, IESR-22 | Multivariable logistic regression | Medical staff facing a serious psychological challenge                   |
| 07 Apr 2020 | Annals of Internal Medicine   | Benjamin YQ Tan et al. [13]| Questionnaire survey                  | N=470 Medical Staff + others | Psychological distress, depression, anxiety, and stress | Depression, Anxiety, and Stress Scales (DASS-21), Impact of Events Scale–Revised (IES-R), PTSD | Risk for psychological distress during the COVID-19 outbreak.             |

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Results and Discussion

The statistics of the included sample in the study is shown in the descriptive statistics in Table 2. A total of n= 18,048 samples from the 8 studies where included in the analysis. All the studies reported the psychological factors like anxiety, depression, stress and insomnia in medical staff and general population during the COVID-19 pandemic. Some studies that were reviewed had also reported cases of PTSD, Suicide, fear and social connect factor related to lockdown. Out of 8 studies 6 was in mainland china and one was in Wuhan city and one was in Singapore (Figure 2).

Table 2: Descriptive statistics of sample population.

| Item                | Sample n | Age | Male | Female | Anxiety | Depression | Stress/ Distress | Insomnia / Poor Sleep |
|---------------------|----------|-----|------|--------|---------|-------------|---------------------|-----------------------|
| Mean                | 2256     | 36.6| 807.8| 1273.1 | 670.8   | 483.9       | 449.9              | 381.339               |
| SD                  | 2572.1   | 6.8 | 1070.3| 1791.1 | 861.4   | 505.6       | 630.4              | 480.728               |
| Skewness            | 1.339    | 0.95| 2.16 | 1.333  | 1.744   | 0.955       | 0.902              | 1.116                 |
| SE of Skewness      | 0.752    | 0.75| 0.75 | 0.752  | 0.752   | 0.752       | 0.752              | 0.752                 |
| Minimum             | 134      | 28  | 53   | 1.401  | 4.96    | 5.76        | 0.001              | 0.001                 |
| Maximum             | 7236     | 49.98| 3284 | 4304   | 2540    | 1454       | 1509               | 1317                  |

The multiple linear regression analysis (Table 3) showed that sample type (β=-0.41, p<0.05), Sample number (β 0.61, p<0.01), age (β=0.30, p<0.05), and gender/male (β =0.58, p<0.01) were associated with anxiety for COVID-19. As compared to anxiety, depression and stress affected people due to COVID-19 to a lesser degree.

Table 3: Multivariate regression analysis of factors associated with anxiety, depression and distress.

For Anxiety: 
- Sample Type: β=-0.41, Std.Err. 0.05, B -487.91, Std.Err. 63.29, t(2) -7.71, p-level 0.02
- Sample n: β 0.61, Std.Err. 0.06, B 0.20, Std.Err. 0.02, t(2) 10.30, p-level 0.01
- Age: β -0.30, Std.Err. 0.04, B -39.15, Std.Err. 5.68, t(2) -6.89, p-level 0.02
- Male: β 0.58, Std.Err. 0.07, B 0.46, Std.Err. 0.05, t(2) 8.67, p-level 0.01

Anxiety R=.99919257 R²=.99838579 Adjusted R²=.99515737 F(4,2)=309.25 p

For Depression: 
- Sample Type: β=-0.42, Std.Err. 0.31, B -286.18, Std.Err. 209.12, t(2) -1.37, p-level 0.30
- Sample n: β 0.47, Std.Err. 0.34, B 0.09, Std.Err. 0.07, t(2) 1.38, p-level 0.30
- Age: β -0.56, Std.Err. 0.25, B -41.31, Std.Err. 18.77, t(2) -2.20, p-level 0.16
- Male: β 0.59, Std.Err. 0.38, B 0.27, Std.Err. 0.17, t(2) 1.53, p-level 0.27

Depression R=.97274700 R²=.94623672 Adjusted R²=.83871016 F(4,2)=8.8000 p
As can be seen from the present analysis that Anxiety, Depression, Stress and Insomnia, amongst other are critical psychological parameters that are affected during painful physical or mental conditions of COVID-19 Pandemic. These four primary parameters of current study that were critically affected during pandemic, were subjected to principal component analysis (PCA). The analysis method of PCA is a dimension reduction procedure by combining a large number of parameters into a smaller set of components based on their correlation or covariance. The PCA analysis was carried out using JASPv0.12.2 and its Scree plot is depicted in Figure 3. The Scree plot shows “elbow” at 2 components. Two principal components PC1 with eigenvalue (Ɛ=2.67) and PC2 having eigenvalue (Ɛ=1.11) were derived. The Path – Analysis plot of is presented in Figure 4. The loadings on the first component PC1 are all positive and loaded across three variables Anxiety, Depression and Insomnia. PC2 have positive and negative loading.

**Figure 3: Scree plot of psychological factor analysis of the Anxiety, Depression, Distress and Insomnia.**

**Figure 4: Principal Component Path Analysis identified a two-component structure PC1 and PC2.**

**Conclusion**

This review indicates that there are many psychological aspects that are affected during the prevailing pandemic which have been evaluated in recent studies. Data analysis reveals that there is considerable evidence to conclude that patients of COVID-19 and general population experienced anxiety and felt unsafe during corona virus pandemic peak period. The Principal Component Analysis allowed critical Psychological parameters...
Anxiety, Depression, Stress and Insomnia to be condensed to two factors PC1 and PC2, for assessing COVID-19 mental health. Besides mental health parameters shooting up, there were confirmed cases of suicide under distress of Corona virus which presents an alarming situation. The present study recommends paying added attention towards the mental health of patients, frontline health care workers, in terms of providing good quality protection gears, psychological support and psychological prescription module as well as strong family supporting and post the COVID-19 epidemic. It also warrants appropriate professional counselling wherever necessary.

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