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# Persistent Psychological Distress and Its Associated Determinants Among Iranian COVID Survivors: A Cross-Sectional Study

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## Abstract

**Background:** The COVID-19 pandemic has resulted in widespread physical and psychological challenges, including persistent psychological distress (PD). Research suggests that while some COVID survivors maintain satisfactory psychological functioning, others may experience long-term, severe PD. Addressing these challenges, along with associated sociodemographic determinants, requires a comprehensive, community-based approach.

**Objectives:** This study aims to determine the prevalence of PD, including depression, anxiety, and stress, among Iranian COVID survivors by analyzing various regional, temporal, and sociodemographic determinants.

**Methods:** The study, conducted between July 2021 and February 2022, aimed to determine persistent PD among Iranian COVID survivors. Ethical approval and other necessary permits were obtained. The final sample size consisted of 300 participants selected from an initial pool of 11,337 medical records. Participants received questionnaires electronically, including the "Socio-Demographic Clinical Questionnaire (SDCQ)" and the "Depression, Anxiety, and Stress Scale 21 (DASS21)." The study used SPSS 26 for statistical analysis, calculating means, standard deviations, and frequencies. Relationships between determinants were examined using ANOVA and chi-square tests. Bayesian regression analysis was employed to explore correlations and predictive power between COVID-19, PD, and the various determinants.

**Results:** The prevalence of depression, anxiety, and stress, considered collectively as PD among participants, was 49%, 53%, and 61%, respectively, with mean severity scores of 10.68 ± 2.16 for depression, 9.18 ± 1.84 for anxiety, and 15.93 ± 2.79 for stress. More severe manifestations of PD were observed in participants from Hospital III ($P > 0.05$, $r \approx 0.17$) and during the temporal period of 12 - 24 weeks post-infection ($P < 0.05$, $r \approx -0.12$). Additionally, significant correlations between PD and determinants such as sex, Intensive Care Unit (ICU) admissions, and intubation were noted ($P < 0.05$). Bayesian analysis further highlighted cross-correlations between PD and other determinants among Iranian COVID survivors ($P < 0.05$, $BF < 0.1$).

**Conclusions:** In conclusion, the study found that Iranian COVID survivors experienced mild levels of depression, anxiety, and stress, with prevalence rates ranging from 49% to 61%. The highest severity of PD was observed in participants from Hospital III and during the period of 12 - 24 weeks post-infection. Additionally, a network of cross-correlations was identified between PD and various other determinants among Iranian COVID survivors.

*Keywords:* Psychological Distress, Depression, Anxiety, Stress, COVID-19, Survivors

## 1. Background

The COVID-19 pandemic, caused by the SARS-CoV-2 virus, has presented a significant global challenge since its initial identification in Wuhan, China, in December 2019 (1). The disease has spread rapidly and widely, leading to a range of symptoms in affected individuals, including fever, cough, and gastrointestinal issues (2).

While some individuals exhibit only mild or subclinical symptoms (3), others may experience severe complications, such as life-threatening respiratory diseases (4). According to data from the World Health Organization (WHO), as of May 5, 2024 (5), over 775 million individuals worldwide have been infected with COVID-19, resulting in over 7 million deaths. In Iran specifically, there have been over 7.5 million confirmed cases and over 147,000 deaths due to the virus (5).

While the majority of people affected by COVID-19 have successfully overcome its acute consequences (6), many continue to suffer from persistent symptoms or endure chronic complications (7). Consequently, a subset of survivors may grapple with new or exacerbated health issues following discharge, particularly those who endured severe respiratory distress and required mechanical ventilation (8). Beyond the physical repercussions, the enduring psychological distress (PD) associated with COVID-19 is a significant concern in terms of long-term consequences (9).

Psychological distress refers to a state of emotional suffering or discomfort resulting from various factors, such as internal conflicts, traumatic events, or chronic stress. It is typically characterized by symptoms such as anxiety, depression, stress, confusion, and feelings of helplessness or hopelessness (10, 11).

Numerous investigations have shown that a subset of people who have successfully overcome COVID-19 experience persistent symptoms of PD for up to two years following initial exposure (9, 12). These findings are largely consistent with some studies conducted in the Iranian population (13, 14). Additionally, empirical evidence has documented persistent afflictions, such as long-term sleep disturbances, among COVID-19 survivors (15). Conversely, some literature suggests that a majority of COVID-19 survivors have been able to restore their psychosocial equilibrium, demonstrating satisfactory psychological functioning following recovery from COVID-19 (16, 17). However, similar results were not observed in Iranian studies, or the findings were not significant enough to note.

As mentioned earlier, existing literature on the PD experienced by COVID-19 survivors has reached heterogeneous conclusions (10-13). Despite this disparity, limited studies have considered the variation in regional and socioeconomic status of participants, as well as the longitudinal effects of persistent PD. These gaps have been addressed thoroughly in the current investigation, along with other sociodemographic indicators in the form of a network of cross-correlations. Furthermore, the detrimental psychological ramifications of COVID-19 on the quality of life and daily activities of both Iranians and individuals worldwide underscore the critical need for further research in this area (18, 19). Numerous studies emphasize the importance of acknowledging the psychological ramifications faced by COVID-19 survivors (12, 15, 16). The tendency for these ramifications to remain subclinical until they cause severe functional impairments (20, 21) underscores the urgency of implementing psycho-cognitive screenings for COVID-19 survivors. This need has been recognized by both Iranian and global researchers in this field (22, 23), highlighting the necessity for healthcare providers to adopt a comprehensive, community-based approach to addressing persistent PD among Iranian COVID survivors, considering the interplay of various sociodemographic determinants. This assertion is particularly relevant given that Iran's socio-cultural context and metrics can influence the persistent PD caused by COVID-19, as emphasized by many local and foreign researchers (24, 25). Overall, while the end of the COVID-19 pandemic may bring a sense of relief and normalcy, it remains crucial to continue studying and monitoring individuals who have recovered from the virus. The long-term effects of COVID-19 on survivors are still not fully understood, and ongoing research is necessary to gain a better understanding of the potential lasting impacts on both physical and mental health. Additionally, studying COVID-19 survivors can provide valuable insights into future public health measures and treatment strategies. Therefore, conducting research on individuals who have recovered from COVID-19 remains essential, even after the pandemic has subsided.

## 2. Objectives

The objective of the current study was to determine the prevalence of PD, including depression, anxiety, and stress, among Iranian COVID survivors, with the aim of identifying any temporal and regional variations, as well as other sociodemographic indicators, through a network of cross-correlations. By analyzing these determinants, we hope to gain insight into the

persistent PD and its associated factors within the survivor population.

## 3. Methods

### 3.1. Study Design and Settings

The present cross-sectional study was conducted between July 2021 and February 2022 with the aim of determining persistent PD in Iranian COVID survivors. In this study, PD was defined as encompassing "depression," "anxiety," and "stress." The study population comprised participants who had survived COVID-19 and were under the care of therapeutic sites affiliated with Shahid Beheshti University of Medical Sciences (SBMU), either hospitalized or referred to home from the emergency department. These sites included hospital I, II, and III, located in the north, central, and south regions of Tehran, respectively. Notably, there is a correlation between the socioeconomic status of residents in these three regions, with those in the north typically having higher socioeconomic levels.

### 3.2. Participants

The sample size for this study was determined using both initial pilot sampling and the minimal probability of occurrence of any psycho-cognitive disorders (effect size: 1.4) through the G-Power version 3.1 software. The significance level was established at $P < 0.05$. Participants included Iranian COVID survivors who had contracted COVID-19 with varying severities [moderate, severe, and critical (26)] within the previous 12 to 72 weeks, based on the onset of COVID symptoms. The diagnosis of COVID-19 was confirmed through participants' medical records. Simple random sampling was employed during the sampling process.

The study began with an initial sample size of 11,337 obtained from the "Hospital Information System" (HIS) of each hospital. From this pool, 2,117 people were randomly selected and subsequently matched based on the predetermined inclusion and exclusion criteria. Following informational telephone screenings, 1,103 participants provided consent to participate. Ultimately, 339 participants completed the entire questionnaire. To ensure a balanced representation of participants across temporal and regional categories, 39 individuals were randomly excluded from the analysis phase. Consequently, a final sample size of 300 participants, evenly distributed across temporal and regional groups, was analyzed, with 100 participants assigned to each group.

### 3.3. Inclusion and Exclusion Criteria

The inclusion criteria for this study required individuals to be aged between 18 - 65 years, with a confirmed diagnosis of moderate to critical COVID-19, supported by valid medical records. Participants needed to have experienced the onset of COVID-19 symptoms within the previous 12 - 72 weeks, willingly agree to participate in the study, be proficient in Persian, demonstrate sufficient decision-making capability, and have no history of previous or current psycho-cognitive disorders, physical impairments, or substance abuse. Additionally, participants were required to have access to the internet, be familiar with internet-based messaging platforms, and possess the knowledge necessary to complete the study questionnaire online. The exclusion criteria included incomplete questionnaires (more than 10%) and participant withdrawal from the study.

### 3.4. Procedures

After obtaining ethical approval and other necessary permissions from the Education and Research Department of SBMU and each hospital, the initial sampling was randomly conducted using the HIS based on a table of random numbers. This process was carried out by the researcher and two colleagues who were fully knowledgeable about the study, its methodology, and the sampling process. Participants who met the predetermined inclusion criteria were then selected. Eligibility verification and participant selection were based on information found in their medical records.

Following this, telephone calls were made to each individual to share relevant information about the study. Participants were provided with the consent form electronically, and their acknowledgment, in the form of an electronic signature, was obtained online. The questionnaires were then distributed to the participants via internet-based messaging platforms (WhatsApp and Telegram) and through Short Message Service (SMS) on the “Porsa_Irandoc” platform. The questionnaires were designed to be straightforward and user-friendly, with each question presented on its own dedicated page. Additionally, participants and their families were

provided with detailed instructions on how to complete the questionnaires through phone consultations to ensure clarity and ease of response.

### 3.5. Instruments

The research methodology employed in this study utilized two main instruments: The “and the “Depression, Anxiety, and Stress Scale 21 (DASS21).” The Socio-Demographic Clinical Questionnaire (SDCQ), designed and revised by the researchers, included questions related to various demographic aspects such as age, gender, marital status, educational status, employment status, economic standing, minimum Arterial Oxygen Saturation ($SaO_2$) levels during hospitalization, duration of hospitalization due to COVID-19, recovery timeline from COVID-19, onset of COVID-19 symptoms, and any history of ICU hospitalization and intubation due to COVID-19. The validity of the SDCQ was confirmed through a qualitative content validity assessment.

The second instrument used was the DASS 21, a shortened version of the Depression, Anxiety, and Stress Scale_42, introduced by Lovibond in 1995. The DASS 21 contains 21 items to measure depression, anxiety, and stress, with each component assessed using 7 questions. Each question was rated on a scale from 0 (never) to 3 (always). Since this questionnaire is a shortened version of the main scale (42 questions), the final score for each subscale was doubled. Depression severity was classified as normal (0 - 9), mild (10 - 13), moderate (14 - 20), severe (21 - 27), or extremely severe (over 28). Anxiety levels were categorized as normal (0 - 7), mild (8 - 9), moderate (10 - 14), severe (15 - 19), or very severe (over 20). Stress severity was determined as normal (0 - 14), mild (15 - 18), moderate (19 - 25), severe (26 - 33), or very severe (over 34) (27).

The Spearman rank correlation coefficient analysis demonstrated a strong positive correlation between the DASS 21 and the Hospital Anxiety and Depression Scale (HADS) scores, with a correlation coefficient of 0.85 ($P < 0.001$). This indicates that both instruments measure similar constructs related to anxiety and depression. The construct validity of the DASS 21 was further supported by a high Cronbach's alpha coefficient of 0.92, indicating good internal consistency. Additionally, factor analysis revealed that the items in the DASS 21 loaded onto three distinct factors corresponding to depression, anxiety, and stress, further validating the instrument. These statistical analyses provide strong evidence for the construct validity of the DASS 21 questionnaire (27).

Reliability testing for the DASS 21 involved calculating internal consistency using Cronbach's alpha coefficients and Spearman rank correlation, both of which exceeded values of 0.7 and 0.6, respectively (28). Additionally, Asghari et al. evaluated the psychometric characteristics of the DASS 21 in Persian. Their findings indicated that the Persian version of the DASS 21 demonstrates strong reliability and validity in assessing depression, anxiety, and stress in Iranian individuals, with high internal consistency reliability coefficients (Cronbach's alpha) of 0.94 for depression, 0.87 for anxiety, and 0.91 for stress (29).

### 3.6. Data Analysis

After data collection was completed, a comprehensive analysis was conducted using both descriptive and inferential statistical methods, customized to fit the distinct nature of the variables in the study and aligned with the established research objectives. The statistical package for the social sciences (SPSS) version 21 was utilized for data analysis, with careful consideration given to test error and adherence to a significance level of 0.05. Before inputting the data into SPSS, the data underwent a thorough process of cleaning and validation to ensure completeness.

Descriptive statistics were computed to summarize the sample's attributes succinctly, while inferential statistics were employed to test hypotheses and elucidate connections among variables. The findings were meticulously interpreted, taking into account both statistical significance and practical implications to support sound conclusions. Quantitative variables were primarily assessed using mean values and their corresponding standard deviations, while qualitative variables were represented by relative frequencies.

The study involved analyzing the relationships between sociodemographic and medical factors and PD subscales using ANOVA and chi-square statistical tests. Additionally, Bayesian regression analysis was employed to investigate cross-correlations and predictive power between PD and other determinants. This approach effectively elucidated the multidimensional correlations among COVID-19, PD, and other

determinants, offering valuable insights into these cross-correlations.

### 3.7. Ethical Considerations

The research study received approval from the SMBU Ethics Committee under reference IR.SBMU.PHARMACY.REC.1400.068. Participants were briefed on ethical guidelines, provided with an electronic consent form, and were informed of their autonomy to withdraw from the study at any time. Confidentiality was strictly maintained, and participants were given the opportunity to report any concerns to the primary researcher. Ethical principles were rigorously followed in the use of study sources, ensuring accuracy and fidelity in sampling, data collection, and analysis. The methods and structures employed in the study were designed to respect participants' religious and cultural norms, with a strong emphasis on adherence to ethical standards throughout the research process. Participants were fully informed of their rights and participated in a study that prioritized ethical considerations at every stage.

## 4. Results

### 4.1. Socio-demographic Determinants and the Values of Psychological Distress Among Iranian COVID Survivors

The results indicated that out of the 300 participants, the majority were female (55.3%), had a higher level of education (59.7%), were employed (53.3%), and had been hospitalized (79.3%). Additionally, only 24 participants (8%) had undergone intubation, and 34 participants (11.3%) had been admitted to the intensive care unit (ICU). The average age of the participants was 41.69 years, with a mean minimum $SaO_2$ level of 78.99%. The mean values for PD in the form of depression, anxiety, and stress were 10.68, 9.18, and 15.93, respectively, with prevalence rates of 49%, 53%, and 61%, respectively. These findings were statistically significant (Table 1).

### 4.2. The Comparison of Psychological Distress Values Based on Various Regional and Temporal Determinants

In the specified region of Hospital III and during the temporal period of 12 - 24 weeks, the most severe manifestations of PD, including depression, anxiety, and stress, were observed, with diverse statistical values and significant implications (Table 2).

### 4.3. Significant Determinants Associated with Psychological Distress Among Iranian COVID Survivors

The results showed that PD among Iranian COVID survivors had significant correlations with various determinants. Depression was significantly correlated with $SaO_2$, sex, ICU admission, and hospitalization. Anxiety showed significant correlations with sex, intubation, employment, and ICU admission. Stress was significantly correlated with sex, intubation, and education. These correlations were statistically significant ($P < 0.05$) (Table 3).

### 4.4. The Cross-correlations Between Psychological Distress and Other Related Determinants Among Iranian COVID Survivors

Based on Bayesian analysis, remarkable results were obtained in the form of a network of cross-correlations between PD and other determinants among the group of Iranian COVID survivors. The cross-correlations demonstrated both the correlation strength and the predictive power between the described determinants (Table 4).

## 5. Discussion

The purpose of the present study was to determine the prevalence and severity of persistent PD and its related determinants among Iranian COVID survivors. As previously mentioned, PD in this study encompassed depression, anxiety, and stress disorders. Despite the reported mild severity of these disorders, they were observed in about half of the studied population, highlighting the significance of post-COVID psychological consequences among Iranian COVID survivors. In this regard, similar studies have yielded mixed results compared to the findings of the present study. Some were consistent, while others were not, which may be attributed to methodological differences and the diversity of sociodemographic and cultural determinants (30-32). In other words, it is possible that the levels of PD fluctuate over time based on these factors, leading to discrepancies in findings between studies.

The current study's findings can be attributed to various factors. Firstly, Iran's collectivist culture places an emphasis on prioritizing the group's well-being over individual needs, potentially causing individuals to feel

**Table 1.** Socio-demographic Determinants and Psychological Distress Values Among Iranian COVID Survivors [a]

| Variables | Total Values |
|---|---|
| **Sex** | |
| Men | 134 (44.7) |
| Women | 166 (55.3) |
| **Education** | |
| Elementary | 66 (22.0) |
| High school | 55 (18.3) |
| University | 179 (59.7) |
| **Employment** | |
| Unemployed | 124 (41.4) |
| Employed | 160 (53.3) |
| Retired | 16 (5.3) |
| **Marital** | |
| Married | 264 (88.0) |
| Unmarried | 36 (12.0) |
| **Hospitalization** | |
| Positive | 238 (79.3) |
| Negative | 62 (20.7) |
| **ICU** | |
| Negative | 266 (88.7) |
| Positive | 34 (11.3) |
| **Intubation** | |
| Negative | 276 (92.0) |
| Positive | 24 (8.0) |
| **Temporal classifications** | |
| 12 - 24 weeks | 100 (33.3) |
| 24 - 48 weeks | 100 (33.3) |
| 48 - 72 weeks | 100 (33.3) |
| **Hospital** | |
| Hospital I | 100 (33.3) |
| Hospital II | 100 (33.3) |
| Hospital III | 100 (33.3) |
| **Age (N = 300)** | 41.69 ± 9.06 |
| **$SaO_2$ (N = 300)** | 78.99 ± 9.99 |
| **Hospitalization Duration (N = 300)** | 5.33 ± 3.61 |
| **PD (N = 300)** | |
| Depression | 147 (49); 10.68 ± 2.16 |
| Anxiety | 159 (53); 9.18 ± 1.84 |
| Stress | 183 (61); 15.93 ± 2.79 |

Abbreviations: $SaO_2$, arterial oxygen saturation; PD, psychological distress; ICU, intensive care unit.

[a] Values are expressed as No (%) or mean ± SD.

guilty or ashamed for experiencing PD (33). Seeking help for mental health issues may also be stigmatized in Iran, leading individuals to suffer in silence and forego necessary support and treatment (34). Additionally, limited resources and access to mental health services in rural or underserved areas of Iran could prevent people from receiving proper care for their PD (35). Finally, the economic repercussions of the pandemic may have exacerbated existing stressors and financial burdens on individuals, further impacting their psychological well-being (36). Overall, the inconsistencies in findings compared to other research highlight the complex nature of PD among COVID survivors and the need for further research to better

**Table 2.** The Values of Psychological Distress Based on the Regional and Temporal Determinants

| Variables | Hospital I X (σ) | Hospital II X (σ) | Hospital III X (σ) | Statistics | | 12 - 24 Weeks X (σ) | 24 - 48 Weeks X (σ) | 48 - 72 Weeks X (σ) | Statistics | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | r | P-Value | | | | r | P-Value |
| **Depression** | 10.58 (2.11) | 10.72 (2.17) | 10.76 (2.21) | 0.17 | 0.11 | 10.98 (2.21) | 10.69 (2.18) | 10.39 (2.14) | 0.12 | 0.04 [a] |
| **Anxiety** | 8.98 (1.74) | 9.18 (1.86) | 9.39 (1.93) | 0.16 | 0.08 | 9.51 (1.94) | 9.11 (1.82) | 8.93 (1.76) | 0.12 | 0.03 [a] |
| **Stress** | 15.79 (2.72) | 15.88 (2.79) | 16.12 (2.86) | 0.17 | 0.09 | 16.29 (2.91) | 15.83 (2.78) | 15.68 (2.69) | 0.13 | 0.02 [a] |

[a] $P < 0.05$.

**Table 3.** Significant Determinants Associated with Psychological Distress Among COVID Survivors

| Variables | Statistic Value | Coefficients Correlation | P-Value |
|---|---|---|---|
| **Depression** | | | |
| $SaO_2$ | F [a] = 1.71, df = 299 | -0.17 | 0.03 [b] |
| Sex | $\chi^2$ [c] = 34.80, df = 3 | 0.32 | 0.001 [b] |
| ICU | $\chi^2$ = 10.88, df = 3 | 0.10 | 0.01 [b] |
| Hospitalization | $\chi^2$ = 10.02, df = 3 | 0.10 | 0.01 [b] |
| **Anxiety** | | | |
| Sex | $\chi^2$ = 30.340, df = 4 | 0.30 | 0.01 [b] |
| Employment | $\chi^2$ = 23.37, df = 12 | -0.21 | 0.02 [b] |
| Intubation | $\chi^2$ = 12.85, df = 4 | 0.08 | 0.01 [b] |
| ICU | $\chi^2$ = 12.97, df = 4 | 0.05 | 0.01 [b] |
| **Stress** | | | |
| Sex | $\chi^2$ = 6.61, df = 2 | 0.12 | 0.03 [b] |
| Intubation | $\chi^2$ = 16.39, df = 2 | 0.13 | 0.02 [b] |
| Education | $\chi^2$=18.55, df = 8 | -0.20 | 0.01 [b] |

Abbreviation: $SaO_2$, arterial oxygen saturation. ICU, intensive care unit.

[a] ANOVA test.

[b] $P < 0.05$ was considered statistically significant.

[c] Chi-square test.

understand the determinants of persistent distress in this population.

Another fundamental finding of this study is that PD was more severe in Hospital III (located in the southern region of Tehran) and during the temporal period of 12 - 24 weeks. Regarding the temporal parameter, it appears that Iranians who have survived COVID-19 and were between 12 to 24 weeks since the initial onset of their illness may not have had adequate time for psychological rehabilitation and adjustment to the crisis, leading to heightened levels of PD. This theory has been validated by corroborating research from other scholars (37, 38). However, in terms of the regional parameter, it should be noted that there is a disparity in economic conditions within the different regions of Tehran. Typically, those living in the northern regions have better economic circumstances compared to those in the central and southern parts. This disparity becomes more apparent as one moves from north to south, with generally worsening economic conditions (39). The finding of more severe PD in Hospital III can be explained by the hypothesis that "enhanced economic prosperity correlates with improved psychological well-being" (40, 41). These findings align with those of numerous other studies (42-44).

Regardless of the debate surrounding the prevalence and severity of PD among Iranian COVID survivors, the correlations identified between PD and other determinants have been substantial. Higher levels of depression were found to have a strong and significant

**Table 4.** The Cross-Correlations Between Psychological Distress and Other Related Determinants Based on the Bayesian Regression Analysis

| Variables (Bayesian Cross-correlations) | Bayesian Factor | P-Value [a] |
|---|---|---|
| **PD * ICU** | 0.09 | 0.03 |
| **PD * sex** | 0.01 | 0.01 |
| **PD * hospital III** | 0.02 | 0.04 |
| **PD * 12 - 24 weeks** | 0.01 | 0.01 |
| **PD * intubation** | 0.06 | 0.01 |
| **Depression * stress** | 0.11 | 0.02 |
| **Depression * anxiety** | 0.13 | 0.04 |
| **Anxiety * stress** | 0.12 | 0.02 |

Abbreviation: PD, psychological distress; ICU, intensive care unit.

[a] $P < 0.05$ was considered statistically significant.

correlation with lower $SaO_2$ levels, being female, having a history of hospitalization, and being admitted to the ICU. Moreover, higher levels of anxiety were positively and significantly associated with being female, ICU admission, and a history of intubation. In the realm of stress, a notable correlation was found between increased stress levels and being female, having a lower level of education, and a history of intubation.

The rationale for these results can be supported by several explanations: "Historically, women have exhibited higher frequencies and severity of mental disorders compared to men due to hormonal fluctuations, societal pressures, and gender-specific stressors" (45); "It is widely known that poorer physical well-being, such as lower $SaO_2$ levels, is linked to more severe mental health conditions, as lower oxygen levels may lead to cardiovascular and respiratory ramifications, which can then contribute to the development or worsening of mental health conditions" (46); "Social well-being, including factors such as employment and education, as well as the ability to participate in meaningful social activities or have access to resources and opportunities, is correlated with psychological well-being" (47); "Hospitalizations, along with invasive procedures, are associated with negative ramifications on mental health due to the physical, emotional, social, and financial stressors involved in these medical experiences" (48). Consequently, these outcomes were both justifiable and foreseeable.

In conclusion, the use of Bayesian regression analysis revealed a network of cross-correlations between PD (comprising depression, anxiety, and stress) and determinants such as being female, a history of ICU admission, and intubation. The interconnected networks found in previous research align with the current study in certain instances (49-53). This network of cross-correlations gains complexity and significance with the uncovering of the reciprocal associations among each of the PD disorders. In other words, depression, anxiety, and stress disorders were found to be interrelated, with the frequency and severity of one potentially intensifying the frequency and severity of the others—demonstrating cross-predictive power. These correlations are in harmony with the findings of other studies (54).

### 5.1. Limitations and Strengths

Given the diverse sociocultural landscape of Iran, the findings of this study, which focused solely on participants from Tehran province, may not be universally generalizable or applicable to all Iranian COVID survivors. Another potential limitation in the generalizability of the study's data is the sample size of 300 Iranian participants, which is relatively small compared to the country's population of 88.55 million. Additionally, since the COVID-19 pandemic was ongoing during the data collection period, it is plausible that some participants' responses may have been influenced by this external factor.

On the other hand, this research makes significant contributions by providing insights into the persistent PD experienced by Iranian COVID survivors, highlighting an important yet often overlooked aspect of the pandemic's consequences. This includes examining the cross-correlations between PD and various other determinants, as well as conducting a

thorough investigation of the disorders with consideration of regional and temporal factors. In summary, utilizing Bayesian regression analysis has offered valuable and comprehensive insights into the cross-correlational network and the predictive power among its components.

### 5.2. Implications

The findings of this study underscore the critical importance of ongoing mental health support for COVID-19 survivors in Iran. The presence of cross-correlations between PD and other determinants within this group highlights the complex nature of mental health outcomes following the pandemic. Consequently, a comprehensive approach to mental health care is essential, one that considers the multiple factors contributing to PD among Iranian survivors.

By analyzing various regional, temporal, and sociodemographic factors, the study sheds light on the significant impact of the COVID-19 pandemic on psychological well-being. This highlights the need for a community-based approach to effectively address these mental health challenges. The findings contribute to a better understanding of the psychological consequences of COVID-19 and offer valuable insights for healthcare professionals and policymakers working with COVID survivors.

It is imperative that healthcare professionals and policymakers in Iran prioritize the mental health needs of individuals who have survived COVID-19. Ensuring that appropriate support services are easily accessible is crucial for addressing their mental well-being. Implementing continuous monitoring and intervention programs can help mitigate persistent COVID-related PD among survivors, ultimately promoting better long-term mental health outcomes.

### 5.3. Conclusions

The present study aimed to determine the prevalence and severity of persistent PD among Iranian COVID survivors. Depression, anxiety, and stress were found in approximately half of the population, with mild severity. Psychological distress was more severe among patients at Hospital III and during the temporal period of 12 - 24 weeks post-infection. A network of cross-correlations was observed between PD and determinants such as gender, history of ICU admission, and intubation. Health professionals and policymakers should recognize the lasting psychological effects of COVID-19 on Iranian survivors and implement targeted interventions to support their well-being. Further research is needed to develop effective strategies for managing and addressing persistent PD in this population.

## Footnotes

**Authors' Contribution:** Study concept and design, F. Gh., A. E., and Ah. Sh.; analysis and interpretation of data, F. Gh.; drafting of the manuscript, Ah. Sh., F. Sh., and G. S.; critical revision of the manuscript for important intellectual content, F. Gh., and A. E.; data collection, Ah. Sh., Fz. M., and Ss. I.

**Conflict of Interests Statement:** The authors declare no conflict of interest.

**Data Availability:** The dataset presented in the study is available on request from the corresponding author during submission or after publication.

**Ethical Approval:** The research study received approval from the SMBU Ethics Committee under reference IR.SBMU.PHARMACY.REC.1400.068 .

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## References

1. Muralidar S, Ambi SV, Sekaran S, Krishnan UM. The emergence of COVID-19 as a global pandemic: Understanding the epidemiology, immune response and potential therapeutic targets of SARS-CoV-2. *Biochimie*. 2020;**179**:85-100. [PubMed ID: 32971147]. [PubMed Central ID: PMC7505773]. https://doi.org/10.1016/j.biochi.2020.09.018.
2. Sharma A, Tiwari S, Deb MK, Marty JL. Severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2): a global pandemic and treatment strategies. *Int J Antimicrob Agents*. 2020;**56**(2):106054. [PubMed ID: 32534188]. [PubMed Central ID: PMC7286265]. https://doi.org/10.1016/j.ijantimicag.2020.106054.
3. Ma Y, Deng J, Liu Q, Du M, Liu M, Liu J. Long-Term Consequences of Asymptomatic SARS-CoV-2 Infection: A Systematic Review and Meta-Analysis. *Int J Environ Res Public Health*. 2023;**20**(2). [PubMed ID: 36674367]. [PubMed Central ID: PMC9863678]. https://doi.org/10.3390/ijerph20021613.
4. Pfortmueller CA, Spinetti T, Urman RD, Luedi MM, Schefold JC. COVID-19-associated acute respiratory distress syndrome (CARDS): Current knowledge on pathophysiology and ICU treatment - A narrative review. *Best Pract Res Clin Anaesthesiol*. 2021;**35**(3):351-68. [PubMed ID:

34511224]. [PubMed Central ID: PMC7831801]. https://doi.org/10.1016/j.bpa.2020.12.011.

5. World Health Organization. *WHO COVID-19 dashboard*. Geneva, Switzerland: World Health Organization; 2024. Available from: https://data.who.int/dashboards/covid19/deaths?n=o https://data.who.int/dashboards/covid19/cases?n=o.
6. Mallah SI, Ghorab OK, Al-Salmi S, Abdellatif OS, Tharmaratnam T, Iskandar MA, et al. COVID-19: breaking down a global health crisis. *Ann Clin Microbiol Antimicrob*. 2021;**20**(1):35. [PubMed ID: 34006330]. [PubMed Central ID: PMC8129964]. https://doi.org/10.1186/s12941-021-00438-7.
7. Wanjari M, Late S, Sharma R, Munjewar P. Long-term pulmonary and extra-pulmonary consequences of COVID-19: A comprehensive review of current evidence and future perspectives. *Narra J*. 2023;**3**(2). e156. [PubMed ID: 38454970]. [PubMed Central ID: PMC10919748]. https://doi.org/10.52225/narra.v3i2.156.
8. Butler MJ, Best JH, Mohan SV, Jonas JA, Arader L, Yeh J. Mechanical ventilation for COVID-19: Outcomes following discharge from inpatient treatment. *PLoS One*. 2023;**18**(1). e0277498. [PubMed ID: 36608047]. [PubMed Central ID: PMC9821470]. https://doi.org/10.1371/journal.pone.0277498.
9. Adorjan K, Stubbe HC. Insight into the long-term psychological impacts of the COVID-19 pandemic. *Eur Arch Psychiatry Clin Neurosci*. 2023;**273**(2):287-8. [PubMed ID: 36971863]. [PubMed Central ID: PMC10040902]. https://doi.org/10.1007/s00406-023-01599-6.
10. Belay AS, Guangul MM, Asmare WN, Mesafint G. Prevalence and Associated Factors of Psychological Distress among Nurses in Public Hospitals, Southwest, Ethiopia: A cross-sectional Study. *Ethiop J Health Sci*. 2021;**31**(6):1247-56. [PubMed ID: 35392329]. [PubMed Central ID: PMC8968359]. https://doi.org/10.4314/ejhs.v31i6.21.
11. Viertio S, Kiviruusu O, Piirtola M, Kaprio J, Korhonen T, Marttunen M, et al. Factors contributing to psychological distress in the working population, with a special reference to gender difference. *BMC Public Health*. 2021;**21**(1):611. [PubMed ID: 33781240]. [PubMed Central ID: PMC8006634]. https://doi.org/10.1186/s12889-021-10560-y.
12. Manchia M, Gathier AW, Yapici-Eser H, Schmidt MV, de Quervain D, van Amelsvoort T, et al. The impact of the prolonged COVID-19 pandemic on stress resilience and mental health: A critical review across waves. *Eur Neuropsychopharmacol*. 2022;**55**:22-83. [PubMed ID: 34818601]. [PubMed Central ID: PMC8554139]. https://doi.org/10.1016/j.euroneuro.2021.10.864.
13. Alizadeh A, Khankeh HR, Barati M, Ahmadi Y, Hadian A, Azizi M. Psychological distress among Iranian health-care providers exposed to coronavirus disease 2019 (COVID-19): a qualitative study. *BMC Psychiatry*. 2020;**20**(1):494. [PubMed ID: 33028290]. [PubMed Central ID: PMC7538532]. https://doi.org/10.1186/s12888-020-02889-2.
14. Khankeh H, Alizadeh A, Nouri M, Bidaki R, Azizi M. Long-term Consequences of the Psychological Distress in Iranian Emergency Medical Personnel: A Qualitative Research. *Health Emerg Disasters Quarterly*. 2022;**8**(1):7-14. FA. https://doi.org/10.32598/hdq.8.1.318.2.
15. Guezguez F, Romdhani M, Boutaleb-Joutei A, Chamari K, Ben Saad H. Management of long-COVID-19 patients with sleep disorders: practical advice to general practitioners. *Libyan J Med*. 2023;**18**(1):2182704. [PubMed ID: 36842064]. [PubMed Central ID: PMC9970199]. https://doi.org/10.1080/19932820.2023.2182704.
16. Reutter M, Hutterer K, Grundahl M, Gall D, Dannlowski U, Domschke K, et al. Mental health improvement after the COVID-19 pandemic in individuals with psychological distress. *Sci Rep*. 2024;**14**(1):5685. [PubMed ID: 38454076]. [PubMed Central ID: PMC10920823]. https://doi.org/10.1038/s41598-024-55839-3.
17. Latronico N, Peli E, Rodella F, Novelli MP, Rasulo FA, Piva S. Three-month outcome in survivors of COVID-19 associated Acute Respiratory Distress Syndrome. *SSRN*. 2021;**Preprint**.
18. Hawlader MDH, Rashid MU, Khan MAS, Liza MM, Akter S, Hossain MA, et al. Quality of life of COVID-19 recovered patients: a 1-year follow-up study from Bangladesh. *Infect Dis Poverty*. 2023;**12**(1):79. [PubMed ID: 37626363]. [PubMed Central ID: PMC10463646]. https://doi.org/10.1186/s40249-023-01125-9.
19. Homayuni A, Hosseini Z, Shahabi N, Ezati Rad R, Moayedi F. Quality of life and its related psychological problems during coronavirus pandemic. *PLoS One*. 2022;**17**(10). e0276841. [PubMed ID: 36315557]. [PubMed Central ID: PMC9621443]. https://doi.org/10.1371/journal.pone.0276841.
20. Lindhardt L, Nilsson LS, Munk-Jorgensen P, Mortensen OS, Simonsen E, Nordgaard J. Unrecognized schizophrenia spectrum and other mental disorders in youth disconnected from education and work-life. *Front Psychiatry*. 2022;**13**:1015616. [PubMed ID: 36386963]. [PubMed Central ID: PMC9645021]. https://doi.org/10.3389/fpsyt.2022.1015616.
21. Baker HA, Safavynia SA, Evered LA. The 'third wave': impending cognitive and functional decline in COVID-19 survivors. *Br J Anaesth*. 2021;**126**(1):44-7. [PubMed ID: 33187638]. [PubMed Central ID: PMC7577658]. https://doi.org/10.1016/j.bja.2020.09.045.
22. Hopkins KL, Underwood T, Iddrisu I, Woldemeskel H, Bon HB, Brouwers S, et al. Community-Based Approaches to Increase COVID-19 Vaccine Uptake and Demand: Lessons Learned from Four UNICEF-Supported Interventions. *Vaccines (Basel)*. 2023;**11**(7). [PubMed ID: 37514996]. [PubMed Central ID: PMC10384848]. https://doi.org/10.3390/vaccines11071180.
23. Rassouli M, Ashrafizadeh H, Shirinabadi Farahani A, Akbari ME. COVID-19 Management in Iran as One of the Most Affected Countries in the World: Advantages and Weaknesses. *Front Public Health*. 2020;**8**:510. [PubMed ID: 33072688]. [PubMed Central ID: PMC7533538]. https://doi.org/10.3389/fpubh.2020.00510.
24. Yap S, Lee A, Ji LJ, Li Y, Dong Y. Cultural Differences in People's Psychological Response to COVID-19. *Front Psychol*. 2021;**12**:636062. [PubMed ID: 34322051]. [PubMed Central ID: PMC8312224]. https://doi.org/10.3389/fpsyg.2021.636062.
25. Charkazi A, Salmani F, Moodi M, Norozi E, Zarei F, Lotfizadeh M, et al. Effects of the COVID-19 pandemic on lifestyle among Iranian population: A multicenter cross-sectional study. *J Res Med Sci*. 2022;**27**:22. [PubMed ID: 35419068]. [PubMed Central ID: PMC8995309]. https://doi.org/10.4103/jrms.jrms_506_21.
26. Struyf T, Deeks JJ, Dinnes J, Takwoingi Y, Davenport C, Leeflang MM, et al. Signs and symptoms to determine if a patient presenting in primary care or hospital outpatient settings has COVID-19. *Cochrane Database Syst Rev*. 2022;**5**(5). CD013665. [PubMed ID: 35593186]. [PubMed Central ID: PMC9121352]. https://doi.org/10.1002/14651858.CD013665.pub3.
27. Lovibond PF, Lovibond SH. The structure of negative emotional states: comparison of the Depression Anxiety Stress Scales (DASS) with the Beck Depression and Anxiety Inventories. *Behav Res Ther*. 1995;**33**(3):335-43. [PubMed ID: 7726811]. https://doi.org/10.1016/0005-7967(94)00075-u.
28. Kumar K, Kumar S, Mehrotra D, Tiwari SC, Kumar V, Dwivedi RC. Reliability and psychometric validity of Hindi version of Depression, Anxiety and Stress Scale-21 (DASS-21) for Hindi speaking Head Neck

Cancer and Oral Potentially Malignant Disorders Patients. *J Cancer Res Ther*. 2019;**15**(3):653-8. [PubMed ID: 31169235]. https://doi.org/10.4103/jcrt.JCRT_281_17.

29. Asghari A, Saed F, Dibajnia P. [Psychometric properties of the Depression Anxiety Stress Scales-21 (DASS-21) in a non-clinical Iranian sample]. *Int J Psychol*. 2008;**2**(2):0. FA.
30. Gad BK, Arafa MA, Attia AF, Farahat AH, Abdou MS. Depression, anxiety, and stress among COVID-19 patients in South Sinai, Egypt: prevalence and associated predictors. *Sci Rep*. 2023;**13**(1):19193. [PubMed ID: 37932329]. [PubMed Central ID: PMC10628151]. https://doi.org/10.1038/s41598-023-45775-z.
31. Lucijanic D, Mihaljevic Peles A, Piskac Zivkovic N, Lucijanic M, Kranjcevic M, Muzinic Marinic L. Relationship of Anxiety, Depression, Stress, and Post-Traumatic Stress Disorder Symptoms with Disease Severity in Acutely Ill Hospitalized COVID-19 Patients. *Behav Sci (Basel)*. 2023;**13**(9). [PubMed ID: 37754012]. [PubMed Central ID: PMC10525712]. https://doi.org/10.3390/bs13090734.
32. Alacevich C, Thalmann I, Nicodemo C, de Lusignan S, Petrou S. Depression and anxiety during and after episodes of COVID-19 in the community. *Sci Rep*. 2023;**13**(1):8257. [PubMed ID: 37217539]. [PubMed Central ID: PMC10201488]. https://doi.org/10.1038/s41598-023-33642-w.
33. Elshamy F, Hamadeh A, Billings J, Alyafei A. Mental illness and help-seeking behaviours among Middle Eastern cultures: A systematic review and meta-synthesis of qualitative data. *PLoS One*. 2023;**18**(10). e0293525. [PubMed ID: 37883515]. [PubMed Central ID: PMC10602270]. https://doi.org/10.1371/journal.pone.0293525.
34. Hajebi A, Hashemian SS, Abolhassani M, Hajebi A, Alizadeh K, Rahnejat AM, et al. Assessing the impact of stigma reduction interventions in Iran: A qualitative study from the perspective of mental health stakeholders. *Front Public Health*. 2022;**10**:1027002. [PubMed ID: 36568742]. [PubMed Central ID: PMC9773400]. https://doi.org/10.3389/fpubh.2022.1027002.
35. Dorosti A, Karamouz M, Asl Rahimi V, Azimzadeh S, Gharaee H, Azami-Aghdash S, et al. Mental Health Services Integration in Primary Health Care in Iran: A Policy Analysis. *Iran J Psychiatry*. 2024;**19**(1):57-69. [PubMed ID: 38420281]. [PubMed Central ID: PMC10896756]. https://doi.org/10.18502/ijps.v19i1.14339.
36. Sabouhi S, Vaezi A, Sharbafchi MR, Aerni A, Bentz D, Coynel D, et al. The Iranian Corona Stress Study: Psychological Impacts of COVID-19 Pandemic in an Iranian Population. *Int J Prev Med*. 2022;**13**:129. [PubMed ID: 36452472]. [PubMed Central ID: PMC9704483]. https://doi.org/10.4103/ijpvm.ijpvm_281_21.
37. Ogden RS. The passage of time during the UK Covid-19 lockdown. *PLoS One*. 2020;**15**(7). e0235871. [PubMed ID: 32628735]. [PubMed Central ID: PMC7337311]. https://doi.org/10.1371/journal.pone.0235871.
38. Daly M, Robinson E. Longitudinal changes in psychological distress in the UK from 2019 to September 2020 during the COVID-19 pandemic: Evidence from a large nationally representative study. *Psychiatry Res*. 2021;**300**:113920. [PubMed ID: 33882397]. [PubMed Central ID: PMC9755113]. https://doi.org/10.1016/j.psychres.2021.113920.
39. Mohammadi MR, Khaleghi A, Badrfam R, Alavi SS, Zandifar A, Ahmadi A, et al. Social capital in general population of Tehran province in comparison with other provinces of Iran. *J Iran Med Council*. 2019;**2**(3):26-34.
40. Barakat C, Konstantinidis T. A Review of the Relationship between Socioeconomic Status Change and Health. *Int J Environ Res Public Health*. 2023;**20**(13). [PubMed ID: 37444097]. [PubMed Central ID: PMC10341459]. https://doi.org/10.3390/ijerph20136249.
41. Zhang Y, Su D, Chen Y, Tan M, Chen X. Effect of socioeconomic status on the physical and mental health of the elderly: the mediating effect of social participation. *BMC Public Health*. 2022;**22**(1):605. [PubMed ID: 35351078]. [PubMed Central ID: PMC8962021]. https://doi.org/10.1186/s12889-022-13062-7.
42. Li M, Zhou B, Hu B. Relationship between Income and Mental Health during the COVID-19 Pandemic in China. *Int J Environ Res Public Health*. 2022;**19**(15). [PubMed ID: 35897317]. [PubMed Central ID: PMC9330058]. https://doi.org/10.3390/ijerph19158944.
43. Lu X, Lin Z. COVID-19, Economic Impact, Mental Health, and Coping Behaviors: A Conceptual Framework and Future Research Directions. *Front Psychol*. 2021;**12**:759974. [PubMed ID: 34899503]. [PubMed Central ID: PMC8660126]. https://doi.org/10.3389/fpsyg.2021.759974.
44. Huang L, Wang D. Socioeconomic Status and Students' Mental Health during the COVID-19 University Closure: Mediating Roles of Perceived Social Support and Self-Efficacy. *Behav Sci (Basel)*. 2023;**13**(10). [PubMed ID: 37887521]. [PubMed Central ID: PMC10604470]. https://doi.org/10.3390/bs13100871.
45. Maestre-Miquel C, Lopez-de-Andres A, Ji Z, de Miguel-Diez J, Brocate A, Sanz-Rojo S, et al. Gender Differences in the Prevalence of Mental Health, Psychological Distress and Psychotropic Medication Consumption in Spain: A Nationwide Population-Based Study. *Int J Environ Res Public Health*. 2021;**18**(12). [PubMed ID: 34208274]. [PubMed Central ID: PMC8296165]. https://doi.org/10.3390/ijerph18126350.
46. Saidi I, Koumeka PP, Ait Batahar S, Amro L. Factors associated with anxiety and depression among patients with Covid-19. *Respir Med*. 2021;**186**:106512. [PubMed ID: 34186260]. [PubMed Central ID: PMC8222859]. https://doi.org/10.1016/j.rmed.2021.106512.
47. Babazadeh T, Ghaffari-Fam S, Shahnavaz-Yoshanluie F, Ranjbaran S. Psychological well-being and factors affecting it after the COVID-19 pandemic. *Front Psychol*. 2024;**15**:1295774. [PubMed ID: 38390417]. [PubMed Central ID: PMC10881793]. https://doi.org/10.3389/fpsyg.2024.1295774.
48. Bonazza F, Borghi L, di San Marco EC, Piscopo K, Bai F, Monforte AD, et al. Psychological outcomes after hospitalization for COVID-19: data from a multidisciplinary follow-up screening program for recovered patients. *Res Psychother*. 2020;**23**(3):491. [PubMed ID: 33585298]. [PubMed Central ID: PMC7875065]. https://doi.org/10.4081/ripppo.2020.491.
49. Woodward SF, Bari S, Vike N, Lalvani S, Stetsiv K, Kim BW, et al. Anxiety, Post-COVID-19 Syndrome-Related Depression, and Suicidal Thoughts and Behaviors in COVID-19 Survivors: Cross-sectional Study. *JMIR Form Res*. 2022;**6**(10). e36656. [PubMed ID: 35763757]. [PubMed Central ID: PMC9604174]. https://doi.org/10.2196/36656.
50. Fico G, Oliva V, De Prisco M, Fortea L, Fortea A, Gimenez-Palomo A, et al. Anxiety and depression played a central role in the COVID-19 mental distress: A network analysis. *J Affect Disord*. 2023;**338**:384-92. [PubMed ID: 37336249]. [PubMed Central ID: PMC10276655]. https://doi.org/10.1016/j.jad.2023.06.034.
51. Dong Y, Chen M, Wu Z, Zhang Z. Covid-19 psychological pressures, depression and FOMO: the mediating role of online social support and emotional regulation. *BMC Psychol*. 2024;**12**(1):116. [PubMed ID: 38431605]. [PubMed Central ID: PMC10908053]. https://doi.org/10.1186/s40359-024-01610-2.
52. Peng P, Wang Y, Li Z, Zhou Y, Wang J, Qu M, et al. A network analysis of the long-term quality of life and mental distress of COVID-19 survivors 1 year after hospital discharge. *Front Public Health*.

2023;**11**:1223429. [PubMed ID: 37575111]. [PubMed Central ID: PMC10416228]. https://doi.org/10.3389/fpubh.2023.1223429.

53. Lu ZA, Shi L, Que JY, Zheng YB, Wang QW, Liu WJ, et al. Long-term psychological profile of general population following COVID-19 outbreak: symptom trajectories and evolution of psychopathological network. *Epidemiol Psychiatr Sci*. 2022;**31**. e69. [PubMed ID: 36165185]. [PubMed Central ID: PMC9531590]. https://doi.org/10.1017/S2045796022000518.

54. Li X, Li L, Wang H, Fennie KP, Chen J, Williams AB. Mediation analysis of health-related quality of life among people living with HIV infection in China. *Nurs Health Sci*. 2015;**17**(2):250-6. [PubMed ID: 25496799]. https://doi.org/10.1111/nhs.12181.