






Comparative Study of COVID-19 Vaccination Frequency Between Chronic Psychiatric Patients and the General Population

Naghmeh Malekpour ¹, Saeid Bitaraf ^{2,3}, Fatemeh Rezaei Rad¹, Maryam Pourshams ^{1,*}

¹ Department of Psychiatry, Golestan Hospital, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran

² Thalassemia & Hemoglobinopathy Research Center, Research Institute of Health, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran

³ Clinical Sciences Research Institute, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran

*Corresponding author: Department of Psychiatry, Golestan Hospital, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran. Email: drpourshams@gmail.com

Received 2024 May 12; Revised 2024 June 2; Accepted 2024 July 1.

Abstract

Background: COVID-19 vaccination rates among individuals with mental illness have raised concerns due to these individuals' increased vulnerability to infection and complications.

Objectives: This study aimed to compare the frequency of COVID-19 vaccination between individuals with chronic psychiatric conditions and the general population.

Methods: A descriptive-analytical study was conducted, including patients with psychiatric disorders and a comparison group without psychiatric problems. Data were collected between May 2023 and August 2023 using a simple random sampling method. Participants were diagnosed with psychiatric disorders according to DSM-5 criteria and completed a questionnaire.

Results: In a study of 137 participants, including 67 healthy individuals, 38 with schizophrenia, and 32 with affective disorders, psychiatric patients had lower full vaccination rates ($P < 0.001$). Patients with schizophrenia received fewer doses than healthy individuals and those with affective disorders (coefficient = -0.54, $P = 0.007$). Even after adjusting for demographics, the relationship between schizophrenia and vaccination rates remained significant.

Conclusions: Chronic psychiatric patients have lower COVID-19 vaccination rates compared to the general population. Targeted vaccination programs and improved access to psychiatric healthcare facilities are crucial for addressing the pandemic's disproportionate impact on this vulnerable group.

Keywords: COVID-19 Vaccination, Schizophrenia, Vaccination Acceptance, Psychiatric Disorders

1. Background

Since 2019, Coronavirus disease 2019 (COVID-19) has rapidly spread across the globe, emerging as a significant global public health crisis (1, 2). Individuals with mental health issues often have higher rates of comorbidities, such as metabolic syndrome, cardiovascular diseases, and respiratory diseases, making them more susceptible to COVID-19 complications. Psychiatric disorders are also associated with factors like poor self-care, medication side effects, challenging social circumstances, and limited access to medical care, which increase their vulnerability during pandemics and raise their risk of infection and complications (3-6).

Recent studies have shown that individuals with severe psychiatric disorders face a 2 - 3 times higher risk

of mortality following COVID-19 infection (7). Furthermore, severe psychiatric disorders, particularly schizophrenia, rank as the second-highest risk factor for COVID-19 mortality and are linked to an increased susceptibility to contracting the novel coronavirus (8). Factors such as mental health disorders, psychotropic medications, and immunological disruptions may elevate the risk of COVID-19 mortality in this population (9). However, vaccination strategies have often overlooked this vulnerable group (10).

Vaccination programs have historically played a key role in controlling diseases like polio, smallpox, and measles. Preventive measures, such as vaccination, are widely recognized as the most effective approach to reducing the risk of COVID-19 infection and its complications (11). Vaccination initiatives are crucial for

lowering both hospital admissions and mortality rates (12).

Several studies have found that vaccination rates among individuals with severe mental illness are comparable to or even higher than those in the general population (1, 13-16). However, contrasting findings have also been reported, with some studies indicating significantly lower vaccination rates among individuals with mental illness (17-20). Factors such as younger age (14, 20) and a diagnosis of schizophrenia (15, 18, 20) have been associated with non-vaccination in some research, although these associations were not consistently observed across all studies (7, 13). Additionally, demographic factors, such as race and socioeconomic status, can influence vaccination uptake among patients with severe mental illness (21).

Vaccination coverage is influenced by various factors, including vaccine production, distribution, and uptake within the population (22). Vaccine uptake is a critical but modifiable barrier to achieving sufficient coverage. Public attitudes toward vaccines and the removal of practical barriers are crucial factors to consider.

A significant challenge for public health authorities is vaccine hesitancy, which is characterized by delayed acceptance or outright refusal of available vaccine services (23). Vaccine hesitancy tends to be more pronounced among individuals with severe mental illness (21) and is influenced by factors such as trust in the vaccine or healthcare provider, understanding of vaccine safety and necessity, and accessibility of vaccination services. Mistrust, misinformation, belief in conspiracy theories, and negative attitudes toward vaccination exacerbate vaccine hesitancy among individuals with mental health disorders. Concerns about potential vaccine risks and side effects can evoke anxiety or fear, particularly among vulnerable groups with severe mental illness (16, 24-26), thereby impacting vaccination rates and contributing to vaccine hesitancy in this population (7).

Individuals with mental health disorders frequently encounter obstacles when seeking primary healthcare services. It is essential to acknowledge that they may have a distinct worldview due to impaired judgment, limited perception, low educational attainment, and feelings of anxiety or fear. Vaccination behaviors and potential adverse effects can induce psychological stress and impact their mental well-being, with the severity of mental symptoms potentially influencing vaccine acceptance (22).

As the COVID-19 pandemic persists, with ongoing high incidence rates and the potential for deadly outcomes, particularly among unvaccinated risk

groups, safeguarding vulnerable and stigmatized populations, such as individuals with severe mental illness, must continue to be a paramount public health priority.

2. Objectives

Given the elevated rates of mortality and morbidity associated with COVID-19 infection, the objective of this study was to compare the frequency of COVID-19 vaccination between chronic psychiatric patients and the general population. To our knowledge, no study has been conducted in developing countries such as Iran regarding COVID-19 vaccination in chronic psychiatric patients.

3. Methods

3.1. Study Design and Data Collection

This descriptive-analytical study included two participant groups: Patients diagnosed with psychiatric disorders, who were referred to the Psychiatry Clinic at Golestan Hospital in Ahvaz, Iran, based on DSM-5 criteria by two psychiatrists, and a comparison group comprising individuals from the general population without psychiatric disorders. Recruitment took place between May 2023 and August 2023, using a simple random sampling method. The patient group was further divided into two categories: Patients with affective disorders and patients with schizophrenia. Ethical approval was obtained from Ahvaz Jundishapur University of Medical Sciences, and participants or their legal guardians provided both oral and written consent. Researchers administered a questionnaire to the participants.

Exclusion criteria included individuals aged 17 years and younger, incomplete questionnaire responses, and challenges with verbal communication or comprehension. Seventy patients with chronic psychiatric disorders were randomly selected from referrals to the psychiatric clinic at Golestan Hospital in Ahvaz. Similarly, 67 individuals for the control group were chosen through the same method from among the companions of patients attending other hospital clinics.

3.2. Measurement

A checklist was used to collect demographic data, including age, gender, marital status, education level, living arrangements, vaccination history, type of psychiatric disorder, past medical history, city of residence, and income.

3.3. Diagnosis of Psychiatric Disorders

Psychiatric diagnoses were established by two independent psychiatrists. All participants were assessed using the diagnostic and statistical manual of mental disorders, 5th edition (DSM-5) (27). Based on these assessments, participants were classified into three groups: Individuals without psychiatric disorders, patients with affective disorders, and patients with schizophrenia. Affective disorders are characterized by significant disturbances in emotions, such as depression, mania, or hypomania (28).

3.4. Ethical Consideration

The study received approval from the Ethics Committee of Ahvaz Jundishapur University of Medical Sciences (IR.AJUMS.REC.1402.019) and adhered to the principles outlined in the declaration of Helsinki, as well as relevant regulations and guidelines. Informed written consent was obtained from all participants involved in the study.

3.5. Sample Size

In accordance with the study conducted by Mazereel et al. (13), vaccination rates were reported as 93% among psychiatrists and 61.6% among the general population. Utilizing the SAMPSI module within STATA software, with a type I error probability set at 0.01 and power at 90%, and considering a 5% to 10% attrition rate, the calculated sample size required for each group is 67.

3.6. Statistical Analysis

Data analysis was performed using Stata version 14 software. The Kolmogorov-Smirnov test was employed to assess the normality of the data. Study data are presented as numbers (percentages) and means (\pm standard deviation). For analysis, analysis of variance, chi-square test, Kruskal-Wallis, and Poisson regression were used. The assumption for Poisson regression was satisfied.

4. Results

4.1. Participant Demographics

The study comprised a total of 137 participants, including 67 individuals without psychiatric disorders (control group), 38 patients diagnosed with schizophrenia, and 32 patients diagnosed with affective disorders. Regarding vaccination attitudes, participants

were grouped into two categories: The first group included individuals with negative beliefs about the vaccine's efficacy or safety, and the second group comprised individuals with insufficient or inaccurate information and training. No statistically significant differences were observed between the groups concerning age, gender, past medical history, city of residence, or living arrangements (Table 1). Table 1 provides detailed information on the demographic and baseline characteristics of the participants.

4.2. Vaccination Patterns

The frequency of complete vaccination across the three groups is as follows: 24 (36%) individuals without psychiatric disorders, 0 (0%) patients with schizophrenia, and 2 (6%) patients with affective disorders (P-value < 0.001). The average number of vaccines administered among individuals without any diagnosed disorder, those with affective disorders, and those diagnosed with schizophrenia were 2.49 ± 1.46 , 2.09 ± 1.15 , and 1.55 ± 1.18 , respectively.

4.3. Association Analysis

4.3.1. Unadjusted Association

Table 2 presents the unadjusted association between the number of vaccinations and the presence of mental illnesses.

According to Table 2, there is a significant relationship between having schizophrenia and the number of vaccines received. As shown in Table 1, patients with schizophrenia received 0.47 fewer units of vaccine compared to healthy individuals, and this relationship is statistically significant (coefficient = -0.47, 95% CI: -0.77 to -0.18, P-value = 0.002).

4.4. Adjusted Relationships

4.4.1. Age and Gender Adjustment

Table 3 shows the adjusted relationship between the number of vaccines received and the presence of mental illnesses, accounting for age and gender.

According to Table 3, there is a significant relationship between having schizophrenia and the number of vaccines received. Schizophrenic patients received 0.47 fewer units of vaccine compared to healthy individuals, and this relationship is statistically significant (Coefficient = -0.47, 95% CI: -0.76 to -0.17, P-value = 0.002). The table also indicates that there was no

Table 1. Baseline Characteristics of Participants^a

Variables	Without Psychiatric Disorders Group (N = 67)	Schizophrenia Group (N = 38)	Affective Disorders Group (N = 32)	P-Value
Age	39.73 ± 14.02	40.84 ± 15.79	34.87 ± 12.22	0.17
Gender				0.33
Male	38 (57)	27 (71)	19 (59)	
Female	29 (43)	11 (29)	13 (41)	
Marital status				0.001
Single	19 (28)	15 (39)	12 (38)	
Married	44 (66)	12 (32)	12 (38)	
Widow	4 (6)	11 (29)	8 (25)	
Education level				< 0.001
Illiterate	2 (3)	12 (32)	1 (3)	
Under high school diploma	8 (12)	12 (32)	10 (31)	
High school diploma	27 (40)	9 (24)	14 (44)	
University degrees	30 (45)	5 (13)	7 (22)	
Past medical history				0.53
No	50 (75)	26 (68)	26 (81)	
CVD	10 (15)	8 (21)	2 (6)	
Diabetes	6 (9)	2 (5)	3 (9)	
Other	1 (1)	2 (5)	1 (3)	
City of residence				0.61
Ahvaz	39 (60)	19 (50)	18 (56)	
Non-Ahvaz	26 (40)	19 (50)	14 (44)	
Living alone/with others				0.080
Alone	5 (7)	8 (21)	2 (6)	
With others	62 (93)	30 (79)	30 (94)	
Income (million Tomans)				< 0.001
Under 80 million IRR ^b	13 (19)	21 (55)	16 (50)	
80 - 200 million IRR	40 (60)	16 (42)	15 (47)	
Over 200 million IRR	14 (21)	1 (3)	1 (3)	
Substance				< 0.001
No	67 (100)	27 (71)	25 (78)	
Yes	0 (0)	11 (29)	7 (22)	

Abbreviation: CVD, cardiovascular diseases.

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

^b IRR, represents the official currency of Iran i.e. Iranian rial.

Table 2. Crude Association Between Psychiatric Disorder and Number of Vaccinations

Number of Vaccinations	Coefficient	P-Value	95% CI
Healthy participants	0		
Schizophrenic patients	-0.47	0.002	-0.77 - (-0.18)
Patients with affective disorders	-0.17	0.228	-0.46 - 0.11

significant relationship between age or sex and the number of vaccines received.

4.4.2. Multivariable Adjustment

Table 4 shows the adjusted relationship between the number of vaccines received and the presence of mental illnesses, considering variables such as age, gender, marital status, education, underlying disease, city of residence, income, and vaccine acceptance.

According to Table 4, there is a significant relationship between having schizophrenia and the number of vaccines received in the adjusted analysis. Schizophrenic patients received 0.54 fewer units of vaccine compared to healthy individuals, and this relationship is statistically significant (coefficient =

-0.54, 95% CI: -0.93 to -0.15, P-value = 0.007). As shown in Table 3, the number of vaccines did not have a significant relationship with the other variables used in the model.

5. Discussion

The findings reveal a lower rate of full vaccination among psychiatric patients compared to the general population. Additionally, the partial vaccination rate is also lower in patients with psychiatric disorders; however, the difference was statistically significant only for patients with schizophrenia. While the partial vaccination rate was lower in patients with affective disorders compared to the general population, this difference was not statistically significant (Table 2).

Table 3. First Adjusted Association Between Psychiatric Disorder and Number of Vaccinations

Number of Vaccinations	Coefficient	P-Value	95% CI
Study groups			
Healthy participants	0		
Schizophrenic patients	-0.47	0.002	-0.76 - -0.17
Patients with affective disorders	-0.15	0.309	-0.43 - 0.14
Age	0.00	0.224	-0.01 - 0.01
Gender	0.11	0.369	-0.13 - 0.34

Table 4. Second Adjusted Association Between Psychiatric Disorder and Number of Vaccinations

Variables	Number of Vaccinations	Coefficient	P-Value	95% CI
Study groups				
Healthy participants		0		
Schizophrenic Patients		-0.54	0.007	(-0.93 - -0.15)
Patients with affective disorders		-0.19	0.269	(-0.54 - 0.15)
Age	0	0.956	-0.02, 0.02	
Gender				
Female		0.04	0.770	(-0.22 - 0.30)
Marital Status				
Single		0		
Married		-0.08	0.676	(-0.44 - 0.29)
Widow		-0.13	0.552	(-0.57 - 0.30)
Education level				
Illiterate		0		
Under high school diploma		-0.15	0.567	(-0.65 - 0.35)
High school diploma		-0.14	0.594	(-0.64 - .37)
University degrees		-0.16	0.583	(-0.74 - 0.41)
Past medical history				
Healthy		0		
CVD		0.19	0.497	(-0.36 - 0.74)
Diabetes		0.12	0.643	(-0.38 - 0.62)
Other		0.41	0.221	(-0.25 - 1.06)
City of residence	-0.01	0.939	(-0.28, 0.26)	
Living alone/with others				
Alone		0		
with others		-0.06	0.820	(-0.54 - 0.43)
Income				
Under 80 million IRR ^a		0		
80 - 200 million IRR		0.26	0.091	(-0.04 - 0.56)
Over 200 million IRR		0.01	0.966	(-0.48 - 0.50)

Abbreviation: CVD, cardiovascular diseases.

^a IRR represents the official currency of Iran i.e. Iranian rial.

These results align with previous studies that attribute lower vaccination rates to individuals with mental illness (8, 17-20).

They underscore the importance of actively and repeatedly offering COVID-19 vaccinations to individuals

with mental disorders through trusted and stigma-free healthcare providers, including psychiatric hospitals, outpatient clinics, and office-based psychiatrists, rather than solely relying on centralized vaccination facilities or somatic medicine providers. Individuals with mental

health disorders typically face limited access to primary healthcare services due to factors such as less social communication, psychiatric symptoms, and adverse effects of pharmacological treatments that interfere with normal life.

It is important to acknowledge that individuals with psychotic disorders may experience the world differently due to poor judgment, limited perception, and severe psychotic symptoms, which limits their connection to public health services and their willingness to receive vaccines compared to the general population and even other psychiatric patients. In addition, patients with schizophrenia often experience more frequent and longer hospitalizations in psychiatric wards than other psychiatric patients. Hospitalization in psychiatric wards, especially if it is accompanied by a lack of vaccination, leads to a decrease in the vaccination rate of these patients.

Vaccine-related behaviors (such as perceptions of safety and availability) and potential adverse effects, such as perceived health threats, can induce high levels of anxiety and psychological distress in all people, especially psychiatric patients, potentially influencing vaccination rates (22).

Negative beliefs about vaccines, such as conspiracy theories (e.g., vaccines being used for human control) or the idea that vaccines are harmful to health, may induce anxiety or fear among certain individuals, especially vulnerable groups with severe mental illness, and contribute to vaccination hesitancy (delayed acceptance or outright refusal of available vaccine services). The presence of negative beliefs about vaccines, mistrust in healthcare services, and difficulties in accessing safe and reliable vaccines are factors that influence vaccination hesitancy in psychiatric patients. This hesitancy can be one of the factors contributing to lower vaccination rates among psychiatric patients (16, 24-26).

After adjusting for variables such as age, sex, education, income, and city of residence, the relationship between having a schizophrenia diagnosis and vaccination rate remained significant. Specifically, patients with schizophrenia received fewer vaccine doses compared to healthy individuals, and this relationship remained statistically significant (coefficient = -0.54) (Table 4). This finding aligns with previous studies showing that the presence of schizophrenia can reduce the rate of vaccine uptake in psychiatric patients (15, 18-20). No significant differences were found between these variables and the low vaccination rate, which contrasts with studies reporting decreased vaccination rates among younger people (14, 20). This difference may be due to variations in the

timing of the studies. It is possible that, in the early stages of the COVID-19 pandemic, younger people were less willing to be vaccinated due to a lower perceived risk, whereas our study was conducted later when awareness of the serious and fatal complications of COVID-19 infection had likely increased. However, socio-economic and cultural differences may also explain this discrepancy.

As COVID-19 continues to pose a deadly threat to unvaccinated high-risk groups, especially in countries like Iran, which lack specialized programs for psychiatric patients, it is crucial to systematically safeguard vulnerable and stigmatized populations. Given that individuals with psychiatric disorders often engage more readily with mental health providers, psychiatric facilities and practitioners should be empowered to administer vaccinations. This approach aims to narrow the mortality and morbidity gap among mentally ill populations during the pandemic.

This study had several limitations. Our sample size was small, and patients were sourced from a teaching hospital, which may limit the generalizability of our findings. Additionally, patients who visit teaching hospitals typically have chronic and more severe forms of illness, and therefore, may not represent the broader population of chronic psychiatric patients. We suggest that future research include more diverse and larger samples using a multicenter approach, including private and outpatient centers, to confirm our findings.

Conducting both quantitative and qualitative studies to understand the barriers to vaccination and to gain a better understanding of the views and experiences of psychiatric patients regarding COVID-19 vaccination would help identify potential obstacles and develop appropriate vaccination programs. The results of this study highlight the importance of educating chronic psychiatric patients and their families about the benefits and necessity of vaccination during epidemics and revising national vaccination programs and related policies to facilitate access to vaccination services for these patients. Considering psychiatric patients as a high-risk group, providing vaccines through home visits, hospitals, and psychiatric offices can lead to appropriate care and minimize adverse consequences.

Footnotes

Authors' Contribution: Study concept and design: S. B, and M. P.; analysis and interpretation of data: N. M., S.B., and M. P.; drafting of the manuscript: N. M., F.R., S.B., and M. P.; critical revision of the manuscript for important

intellectual content: N. M., S. B., F. R., and M. P.; statistical analysis: S. B., and M. P.

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 study received approval from the Ethics Committee of Ahvaz Jundishapur University of Medical Sciences (IR.AJUMS.REC.1402.019) and adhered to the principles outlined in the declaration of Helsinki, along with relevant regulations and guidelines. Informed written consent was obtained from all participants involved in the study.

Funding/Support: This study was not financially supported by any organization or institution.

Informed Consent: Written informed consent was obtained from all participants.

References

- Mazereel V, Van Assche K, Detraux J, De Hert M. COVID-19 vaccination for people with severe mental illness: why, what, and how? *Lancet Psychiatry*. 2021;**8**(5):444-50. [PubMed ID: 33548184]. [PubMed Central ID: PMC7906686]. [https://doi.org/10.1016/S2215-0366\(20\)30564-2](https://doi.org/10.1016/S2215-0366(20)30564-2).
- Sallam M. COVID-19 Vaccine Hesitancy Worldwide: A Concise Systematic Review of Vaccine Acceptance Rates. *Vaccines (Basel)*. 2021;**9**(2). [PubMed ID: 33669441]. [PubMed Central ID: PMC7920465]. <https://doi.org/10.3390/vaccines9020160>.
- Vai B, Mazza MG, Delli Colli C, Foiselle M, Allen B, Benedetti F, et al. Mental disorders and risk of COVID-19-related mortality, hospitalisation, and intensive care unit admission: a systematic review and meta-analysis. *Lancet Psychiatry*. 2021;**8**(9):797-812. [PubMed ID: 34274033]. [PubMed Central ID: PMC8285121]. [https://doi.org/10.1016/S2215-0366\(21\)00232-7](https://doi.org/10.1016/S2215-0366(21)00232-7).
- Toubasi AA, AbuAnzeh RB, Tawileh HBA, Aldebei RH, Alryalat SAS. A meta-analysis: The mortality and severity of COVID-19 among patients with mental disorders. *Psychiatry Res*. 2021;**299**:113856. [PubMed ID: 33740483]. [PubMed Central ID: PMC7927594]. <https://doi.org/10.1016/j.psychres.2021.113856>.
- Wang QQ, Kaelber DC, Xu R, Volkow ND. COVID-19 risk and outcomes in patients with substance use disorders: analyses from electronic health records in the United States. *Mol Psychiatry*. 2021;**26**(1):30-9. [PubMed ID: 32929211]. [PubMed Central ID: PMC7488216]. <https://doi.org/10.1038/s41380-020-00880-7>.
- Wang Q, Xu R, Volkow ND. Increased risk of COVID-19 infection and mortality in people with mental disorders: analysis from electronic health records in the United States. *World Psychiatry*. 2021;**20**(1):124-30. [PubMed ID: 33026219]. [PubMed Central ID: PMC7675495]. <https://doi.org/10.1002/wps.20806>.
- Mazereel V, Vanbrabant T, Desplenter F, De Hert M. COVID-19 vaccine uptake in patients with psychiatric disorders admitted to or residing in a university psychiatric hospital. *Lancet Psychiatry*. 2021;**8**(10):860-1. [PubMed ID: 34416185]. [PubMed Central ID: PMC8372496]. [https://doi.org/10.1016/S2215-0366\(21\)00301-1](https://doi.org/10.1016/S2215-0366(21)00301-1).
- Mina MJ, Peto TE, Garcia-Finana M, Semple MG, Buchan IE. Clarifying the evidence on SARS-CoV-2 antigen rapid tests in public health responses to COVID-19. *Lancet*. 2021;**397**(10283):1425-7. [PubMed ID: 33609444]. [PubMed Central ID: PMC8049601]. [https://doi.org/10.1016/S0140-6736\(21\)00425-6](https://doi.org/10.1016/S0140-6736(21)00425-6).
- De Hert M, Mazereel V, Stroobants M, De Picker L, Van Assche K, Detraux J. COVID-19-Related Mortality Risk in People With Severe Mental Illness: A Systematic and Critical Review. *Front Psychiatry*. 2021;**12**:798554. [PubMed ID: 35095612]. [PubMed Central ID: PMC8793909]. <https://doi.org/10.3389/fpsy.2021.798554>.
- De Picker LJ, Dias MC, Benros ME, Vai B, Branchi I, Benedetti F, et al. Severe mental illness and European COVID-19 vaccination strategies. *Lancet Psychiatry*. 2021;**8**(5):356-9. [PubMed ID: 33609450]. [PubMed Central ID: PMC7906735]. [https://doi.org/10.1016/S2215-0366\(21\)00046-8](https://doi.org/10.1016/S2215-0366(21)00046-8).
- Souliotis K, Peppou IE, Giannouchos TV, Samara M, Sifaki-Pistolla D, Economou M, et al. COVID-19 Vaccination and Mental Health Outcomes among Greek Adults in 2021: Preliminary Evidence. *Vaccines (Basel)*. 2022;**10**(8). [PubMed ID: 36016258]. [PubMed Central ID: PMC9412301]. <https://doi.org/10.3390/vaccines10081371>.
- World Health Organization. *WHO SAGE values framework for the allocation and prioritization of COVID-19 vaccination*. Geneva, Switzerland: World Health Organization; 2020. Available from: <https://www.who.int/publications/i/item/who-sage-values-framework-for-the-allocation-and-prioritization-of-covid-19-vaccination>.
- Mazereel V, Vanbrabant T, Desplenter F, Detraux J, De Picker L, Thys E, et al. COVID-19 Vaccination Rates in a Cohort Study of Patients With Mental Illness in Residential and Community Care. *Front Psychiatry*. 2021;**12**:805528. [PubMed ID: 34975599]. [PubMed Central ID: PMC8716918]. <https://doi.org/10.3389/fpsy.2021.805528>.
- Peritogiannis V, Drakatos I, Gioti P, Garbi A. Vaccination rates against COVID-19 in patients with severe mental illness attending community mental health services in rural Greece. *Int J Soc Psychiatry*. 2023;**69**(1):208-15. [PubMed ID: 35253527]. [PubMed Central ID: PMC9936167]. <https://doi.org/10.1177/00207640221081801>.
- Hassan L, Sawyer C, Peek N, Lovell K, Carvalho AF, Solmi M, et al. COVID-19 vaccination uptake in people with severe mental illness: a UK-based cohort study. *World Psychiatry*. 2022;**21**(1):153-4. [PubMed ID: 35015350]. [PubMed Central ID: PMC8751570]. <https://doi.org/10.1002/wps.20945>.
- Edara VV, Hudson WH, Xie X, Ahmed R, Suthar MS. Neutralizing Antibodies Against SARS-CoV-2 Variants After Infection and Vaccination. *JAMA*. 2021;**325**(18):1896-8. [PubMed ID: 33739374]. [PubMed Central ID: PMC7980146]. <https://doi.org/10.1001/jama.2021.4388>.
- Huang H, Zhu XM, Liang PW, Fang ZM, Luo W, Ma YM, et al. COVID-19 Vaccine Uptake, Acceptance, and Hesitancy Among Persons With Mental Disorders During the Second Stage of China's Nationwide Vaccine Rollout. *Front Med (Lausanne)*. 2021;**8**:761601. [PubMed ID: 34901076]. [PubMed Central ID: PMC8660117]. <https://doi.org/10.3389/fmed.2021.761601>.
- Tzur Bitan D. Patients with schizophrenia are under-vaccinated for COVID-19: a report from Israel. *World Psychiatry*. 2021;**20**(2):300-1. [PubMed ID: 34002527]. [PubMed Central ID: PMC8129849]. <https://doi.org/10.1002/wps.20874>.
- Arumham A, O'Brien O, Ahmad Z, Nikbin K, Howes OD. Low COVID-19 vaccination rates in people with severe mental illness and reasons for this: An out-patient study. *Acta Psychiatr Scand*. 2022;**145**(4):416-8. [PubMed ID: 35263443]. [PubMed Central ID: PMC9111255]. <https://doi.org/10.1111/acps.13400>.
- Tzur Bitan D, Kridin K, Cohen AD, Weinstein O. COVID-19 hospitalisation, mortality, vaccination, and postvaccination trends among people with schizophrenia in Israel: a longitudinal cohort study. *Lancet Psychiatry*. 2021;**8**(10):901-8. [PubMed ID: 34364406]. [PubMed Central ID: PMC8342316]. [https://doi.org/10.1016/S2215-0366\(21\)00256-X](https://doi.org/10.1016/S2215-0366(21)00256-X).

21. Koltai J, Raifman J, Bor J, McKee M, Stuckler D. COVID-19 Vaccination and Mental Health: A Difference-In-Difference Analysis of the Understanding America Study. *Am J Prev Med.* 2022;**62**(5):679-87. [PubMed ID: 35012830]. [PubMed Central ID: PMC8674498]. <https://doi.org/10.1016/j.amepre.2021.11.006>.
22. Smith K, Lambe S, Freeman D, Cipriani A. COVID-19 vaccines, hesitancy and mental health. *Evid Based Ment Health.* 2021;**24**(2):47-8. [PubMed ID: 33849994]. [PubMed Central ID: PMC10231595]. <https://doi.org/10.1136/ebmental-2021-300266>.
23. Cai H, Bai W, Du X, Zhang L, Zhang L, Li YC, et al. COVID-19 vaccine acceptance and perceived stigma in patients with depression: a network perspective. *Transl Psychiatry.* 2022;**12**(1):429. [PubMed ID: 36195590]. [PubMed Central ID: PMC9530420]. <https://doi.org/10.1038/s41398-022-02170-y>.
24. Cines DB, Bussel JB. SARS-CoV-2 Vaccine-Induced Immune Thrombotic Thrombocytopenia. *N Engl J Med.* 2021;**384**(23):2254-6. [PubMed ID: 33861524]. [PubMed Central ID: PMC8063912]. <https://doi.org/10.1056/NEJMe2106315>.
25. Simone A, Herald J, Chen A, Gulati N, Shen AY, Lewin B, et al. Acute Myocarditis Following COVID-19 mRNA Vaccination in Adults Aged 18 Years or Older. *JAMA Intern Med.* 2021;**181**(12):1668-70. [PubMed ID: 34605853]. [PubMed Central ID: PMC8491129]. <https://doi.org/10.1001/jamainternmed.2021.5511>.
26. Chou WS, Budenz A. Considering Emotion in COVID-19 Vaccine Communication: Addressing Vaccine Hesitancy and Fostering Vaccine Confidence. *Health Commun.* 2020;**35**(14):1718-22. [PubMed ID: 33124475]. <https://doi.org/10.1080/10410236.2020.1838096>.
27. American Psychiatric Association. *Diagnostic and statistical manual of mental disorders: DSM-5.* Washington, DC: American Psychiatric Association; 2013.
28. Sekhon S, Gupta V. Mood Disorder. *StatPearls.* Treasure Island (FL): StatPearls Publishing Copyright © 2024, StatPearls Publishing LLC; 2024.