



One-year results from the vaccination campaign against COVID-19 infection in 47 million individuals with severe mental disorders and other chronic diseases

Guillaume Fond^{1,2,4} · Dong Keon Yon³ · Laurent Boyer^{1,2}

Received: 9 May 2022 / Accepted: 2 August 2022

© The Author(s), under exclusive licence to Springer-Verlag GmbH Germany 2022

Abstract

Severe mental disorders have been associated with increased COVID-19 mortality. The aim of this study was to evaluate the results of the vaccination campaign against COVID-19 after 1 year using exhaustive population-based data. In this nationwide population-based study, we used data from the French national medico-administrative database (SNDS) and the COVID Vaccine teleservice from January 4, 2021 (date of activation of the teleservice) to January 30th, 2022. As of January 30th, 2022, the rate of first injection in France was 80.2% (54 million people) and the rate of booster vaccination was 78.3% (52.7 million people). Except for opioid use disorder, all individuals with chronic illnesses or risk factors for poor COVID-19 outcome (e.g., smoking and obesity) had higher rates of vaccination than the general population (from 83.4 to 94.5% vs. 78.3%). However, the four diseases ranking last for both initial and booster vaccinations were mental disorders: alcohol use disorders (86 and 84.3%), neurodevelopmental psychiatric disorders (85.3 and 83.7%), schizophrenia-spectrum disorder (85 and 83.4%) and opioid use disorders (72.9 and 69.4%). Except for opioid disorders, all patients with mental disorders had higher rates of vaccination compared to the general population. However, these rates were lower than other chronic diseases at risk of severe COVID-19 outcomes. Vaccination campaigns must redouble their efforts to improve vaccination penetration in patients with mental disorders.

Keywords Mental health · Psychiatry · Schizophrenia · Mood disorders · Depressive disorders · COVID-19

Introduction

Adequate vaccination coverage against COVID-19 is an important step to fight against this pandemic. The vaccine campaign began in Europe in February 2021. The EU advises prioritizing vaccination for people at risk for severe COVID-19, but leaves it to member states to decide which medical conditions get prioritized. Early after the first wave

of the pandemic, analysis of population-based data found increased risk of COVID-19 infection and mortality in individuals with severe psychiatric disorders [1]. This finding was replicated in multiple countries across the world by investigators reporting a constant increase in risk of COVID-19 mortality in patients with psychiatric disorders. We synthesized these data in a recent meta-analysis [2]. Among all patients with mental disorders who were studied, those with severe mental disorders (schizophrenia and bipolar disorders) were at the highest risk of COVID-19 mortality. Soon after this publication, the Center for Disease Control and Prevention (CDC) updated its list of conditions associated with severe COVID-19, including severe mental disorders.

However, vaccination strategies have often overlooked these patients. Despite the scientific evidence for increased risk, patients with severe psychiatric disorders were listed in the priority groups for vaccination against COVID-19 in only 8 of 20 European countries (Belgium, Denmark, France, Germany, Malta, the Netherlands, Spain and the UK). Only four of them (Denmark, Germany, the Netherlands, and the

✉ Guillaume Fond
guillaume.fond@ap-hm.fr

¹ AP-HM, Aix-Marseille University, CERESS-Health Service Research and Quality of Life Center, 27 Boulevard Jean Moulin, 13005 Marseille, France

² Fondation FondaMental, Créteil, France

³ Medical Science Research Institute, Kyung Hee University College of Medicine, Seoul, South Korea

⁴ AP-HM, Saint-Marguerite Hospital, 276 bd Ste Marguerite, 13009 Marseille, France

UK) had some form of higher vaccination priority for outpatients with severe mental illness. Some other countries listed institutionalized patients or patients with disabilities, possibly including patients with severe mental disorders.

Several studies have shown that patients with psychiatric disorders had paradoxically lower vaccinations rates and higher vaccination hesitancy compared to the rest of the population [3].

The aim of this study was to evaluate the results of this vaccination campaign after 1 year using exhaustive population-based data.

Methods

Data sources and population

In this nationwide population-based study, we used data from the French national medico-administrative database (SNDS) and the COVID Vaccine teleservice from January 4, 2021 (date of activation of the teleservice) to January 30th, 2022. The SNDS covers approximately 99% of the population for which medical data are systematically collected. A mapping of chronic diseases according to a validated algorithm developed by the French National Health Insurance is available [4]. This information system centralizes individual COVID-19 vaccination data to ensure traceability for pharmacovigilance and vaccination campaign management purposes. The vaccination data were matched to the SNDS in order to provide vaccination rates according to diagnoses of chronic medical and psychiatric diseases.

Indicators' definition

The first injection rate is the number of patients who received at least one first injection of vaccine. The initial completed vaccination rate is the percentage of patients whose vaccination was considered completed, defined as: two vaccine injections (general case), a single vaccine injection with COVID-19 infection (before or after the first injection), a single injection with Janssen vaccine, or three vaccine injections for immunocompromised patients.

Mental disorders were defined by the International Classification of Disease codes and the use of some treatments when specific of a disorder. The algorithms that define the disease groups use some of the following elements:

- codes from the 10th International Classification of Diseases (ICD-10).
- drugs that are quasi-specific to certain diseases.
- ICD-10 codes for hospitalization diagnoses (principal diagnosis, related diagnosis, and associated diagnosis).

The following groups of mental disorders were defined: alcohol use disorders (F10*), opioid use disorders (F11*), schizophrenia-spectrum disorders [F20* to F29*] or chronic antipsychotic treatment (ATC code N05A except for N05AN01 and N05AL06), anxiety and mood disorders ([F30* to F48*] or chronic antidepressant or mood regulator treatment (N06A, N05AN01, N03AG01, N03AG02), neurodevelopmental psychiatric disorders (F80*–F89*). The identification of a condition in year n may use data from up to 5 years (years n to $n - 4$). The diseases are mostly non-exclusive as the same individual may be affected by several conditions. For example, a person being treated for cancer and a psychiatric condition will fall into both groups of conditions. The details for group definitions are available at <https://www.epi-phare.fr/>. The detailed method to define the schizophrenia-spectrum disorders or chronic antipsychotic treatment group is available on the French Assurance website and detailed in Appendix [5]. The chronic antipsychotic treatment was included to identify outpatients followed up in the private sector.

Ethical considerations

Since the data were anonymized, no informed consent was required.

Results

As of January 30th, 2022, the rate of first injection in France was 80.2% (54 million people) and the rate of booster vaccination was 78.3% (52.7 million people). The results for severe mental disorders and other chronic diseases are presented in Table 1 and geographical disparities in Fig. 1. Except for opioid use disorder, all individuals with chronic illnesses or risk factors for poor COVID-19 outcome (e.g., smoking and obesity) had higher rates of vaccination than the general population (from 83.4 to 94.5% vs. 78.3%). However, the four diseases ranking last for both initial and booster vaccinations were mental disorders: alcohol use disorders (86 and 84.3%), neurodevelopmental psychiatric disorders (85.3 and 83.7%), schizophrenia-spectrum disorder (85 and 83.4%) and opioid use disorders (72.9 and 69.4%).

Discussion

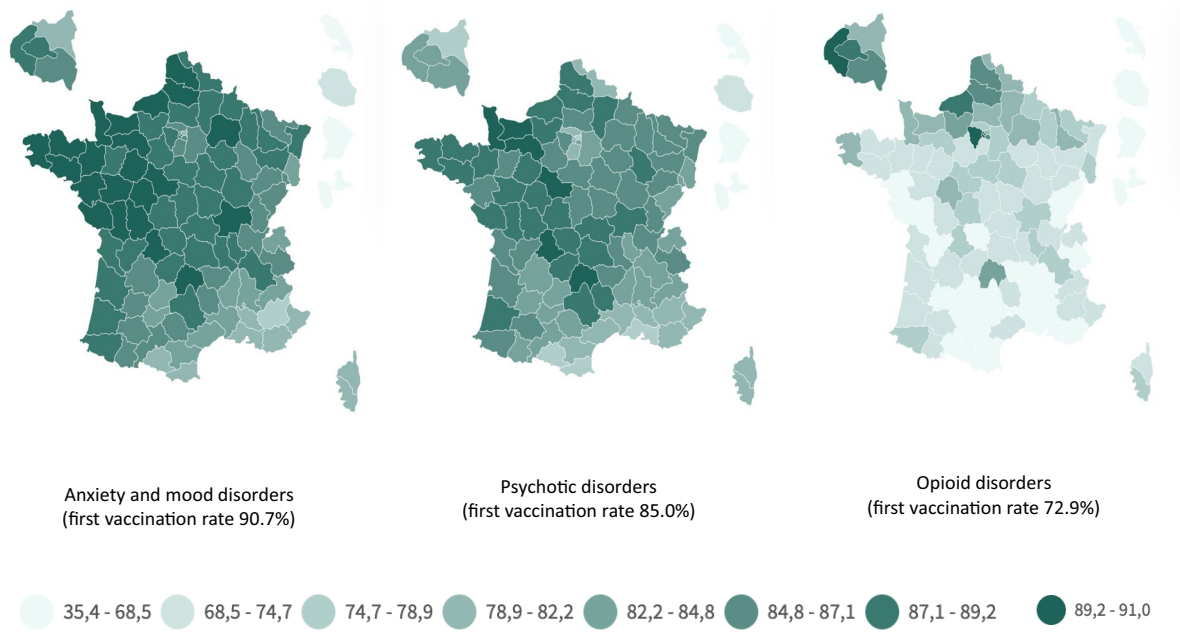
Our results confirm preliminary results suggesting that patients with substance use disorders have lower rates than the rest of the population [3, 6], especially for opioid use disorders. The COVID-19 pandemic collided with the opioid epidemic and longstanding health inequities to exacerbate the disproportionate harms experienced by persons

Table 1 Ranking of diseases by decreasing rate of complete initial vaccination schedule in the whole French population ($N=47,200,050$)

Disease	<i>N</i>	First injection rate (%)	Rate of completed initial vaccination schedule (%)
Lung transplantation	1170	95.1	94.5
Prostate cancer under surveillance	288,720	94.0	93.6
Liver transplantation	4330	94.0	93.5
Hypolipidemic treatments	6,601,480	93.7	93.2
Prostate cancer in active treatment	181,110	93.3	92.8
Lung cancer under surveillance	47,780	93.0	92.4
Colorectal cancer under surveillance	202,270	92.3	91.6
Female breast cancer under surveillance	460,660	92.2	91.6
Chronic dialysis	40,950	92.1	91.2
Coronary artery disease	1,871,650	91.8	91.1
Antihypertensive treatments	11,755,580	91.8	91.1
Renal transplantation	40,190	91.7	91.0
Female breast cancer in active treatment	201,680	91.5	90.9
Other cancers in active treatment phase	642,510	91.6	90.9
Other cancers under surveillance	857,760	91.5	90.9
Heart transplants	1420	91.7	90.8
Colorectal cancer in active treatment	109,820	91.3	90.7
Lung cancer in active treatment	56,450	91.3	90.7
Cystic fibrosis	5660	91.4	90.5
Valvular disease	574,860	91.2	90.3
Cardiac rhythm or conduction disorders	2,068,860	91.1	90.2
Obliterative arteriopathy of the lower limb	585,130	90.9	90.1
Hereditary metabolic diseases or amyloidosis	95,620	90.8	90.1
Parkinson's disease	232,670	91.0	90.1
Rheumatoid arthritis and related diseases	276,600	90.6	89.8
Anxiety and mood disorders or chronic antidepressant or mood regulator treatment	4,173,770	90.7	89.8
Diabetes	3,739,430	90.1	89.4
Mental retardation	101,940	90.4	89.4
Trisomy 21	24,140	90.0	89.4
Chronic respiratory diseases (excluding cystic fibrosis)	2,893,540	89.6	88.7
Ankylosing spondylitis and related diseases	222,000	89.4	88.6
Psoriasis	290,690	89.4	88.5
Pulmonary embolism	142,280	89.2	88.2
Chronic inflammatory bowel diseases	269,010	88.7	87.9
Obesity (hospital stay)	860,340	88.7	87.8
Stroke	796,830	88.7	87.7
Heart failure	592,190	88.4	87.3
Hemophilia or severe hemostasis disorders	46,800	88.0	87.2
Myopathy or myasthenia	41,810	87.7	86.8
Dementia (including Alzheimer's disease)	481,470	88.0	86.7
Smoking	2,656,380	87.9	86.7
Liver disease	363,010	87.7	86.5
HIV infection	145,490	87.3	86.1
Epilepsy	269,340	86.3	85.0
Multiple sclerosis	113,900	86.0	84.8
Paraplegia	83,250	85.9	84.7
Alcohol use disorders	697,180	86.0	84.3
Neurodevelopmental psychiatric disorders	55,340	85.3	83.7

Table 1 (continued)

Disease	<i>N</i>	First injection rate (%)	Rate of completed initial vaccination schedule (%)
Psychotic disorders or chronic antipsychotic treatment	728,440	85.0	83.4
Opioid use disorder	206,550	72.9	69.4

**Fig. 1** Geographical disparities

with opioid use disorder [7]. High doses of opioids might exacerbate the respiratory depression found in COVID-19 patients and their chronic use can trigger opioid tolerance [8]. The higher doses used during the pandemic might result in greater adverse effects and increased risk of COVID-19 infection and mortality [9–11]. Opioid use disorders have, therefore, been targeted as a population at a particular risk of COVID-19 mortality. However, the patients were reported to have high rates of vaccination hesitancy and lower adherence to CDC guidelines [12], which is confirmed in our results.

Contrary to Israel [13], individuals with schizophrenia-spectrum disorders have higher rates of initial vaccination and booster vaccination compared to those without schizophrenia-spectrum disorders in France. This high rate of vaccination may be explained by the prioritization for vaccination of patients with mental disorders following the publication of the mortality data of these individuals in France [1]. People with schizophrenia who are not included in the healthcare system (e.g., homeless people) may not be captured in the present results, which may lead

to a (small) overestimation of the prevalence of vaccination in this population [14, 15].

Limitations

Distribution by disease is not possible for patients not matched to the SNDS (approximately 1% of the population).

Conclusion

Except for opioid disorders, all the patients with mental disorders had higher rates of vaccination compared to the general population. However, these rates were lower than other chronic diseases at risk of severe COVID-19 outcomes. Vaccination campaigns must redouble their efforts to improve vaccination penetration in patients with mental disorders.

Appendix: Definition of the schizophrenia-spectrum disorder or chronic antipsychotic treatment group

Individual with a long-term condition in year n with ICD-10 codes of schizophrenia, schizotypal disorder, persistent delusional disorder, acute and transient psychotic disorder, induced delusional disorder, schizoaffective disorder, other non-organic psychotic disorders, non-organic psychosis without specification, and/or individuals hospitalized for these same reasons—in a non-psychiatric health establishment (Medicine, surgery, obstetrics (main or related diagnosis) and/or Follow-up and rehabilitation care (main disease manifestation, etiological affection)) and/or psychiatric facility (main or associated diagnosis)—during years n to $n - 1$, and/or individuals hospitalized for these same reasons in a non-psychiatric health establishment (Medicine, surgery, obstetrics (main, related or associated diagnosis, or main or related diagnosis of one of the Medical Unit Summaries)) and/or Follow-up and rehabilitation care (main disease manifestation, etiological affection or associated diagnosis)), etiological condition or associated diagnosis) and/or psychiatric care (main or associated diagnosis)—during years n to $n - 4$ OR having received at least 3 deliveries of neuroleptics during year n (on different dates), i.e., a drug with an ATC code (Anatomical Therapeutic Chemical Classification) beginning with N05A, with the exception of Lithium-based specialities (used as a mood stabilizer) and Neuripège® (muscle relaxant).

Data sharing The data are available on request to the corresponding author.

Declarations

Conflict of interest The authors report no conflicts of interest and no drug manufactory was involved at any stage of this manuscript.

References

- Fond PV, Leone M et al (2020) Disparities in intensive care unit admission and mortality among patients with schizophrenia and COVID-19: a national cohort study. *Schizophr Bull*. <https://doi.org/10.1093/schbul/sbaa158>
- Fond G, Nemani K, Etchecopar-Etchart D et al (2021) Association between mental health disorders and mortality among patients with COVID-19 in 7 countries: a systematic review and meta-analysis. *JAMA Psychiat*. <https://doi.org/10.1001/jamapsychiatry.2021.2274>
- Eyllon M, Dang AP, Barnes JB et al (2022) Associations between psychiatric morbidity and COVID-19 vaccine hesitancy: an analysis of electronic health records and patient survey. *Psychiatry Res* 307:114329. <https://doi.org/10.1016/j.psychres.2021.114329>
- Maladie L'Assurance (2021) Méthode de la cartographie des pathologies et des dépenses de l'Assurance Maladie. <https://assurance-maladie.ameli.fr/etudes-et-donnees/par-theme/pathologies/cartographie-assurance-maladie/methode-cartographie-pathologies-dépenses-assurance-maladie>
- (2019) Personnes prises en charge pour troubles psychotiques en 2019. https://www.ameli.fr/sites/default/files/2019_fiche_troubles-psychotiques.pdf. Accessed 31 Jan 2022
- Mazereel V, Vanbrabant T, Desplenter F et al (2021) COVID-19 vaccination rates in a cohort study of patients with mental illness in residential and community care. *Front Psychiatry* 12:805528. <https://doi.org/10.3389/fpsy.2021.805528>
- Rosales R, Janssen T, Yermash J et al (2022) Persons from racial and ethnic minority groups receiving medication for opioid use disorder experienced increased difficulty accessing harm reduction services during COVID-19. *J Subst Abuse Treat* 132:108648. <https://doi.org/10.1016/j.jsat.2021.108648>
- Palamim CVC, Boschiero MN, Faria AG et al (2021) Opioids in COVID-19: two sides of a coin. *Front Pharmacol* 12:758637. <https://doi.org/10.3389/fphar.2021.758637>
- Tuan W-J, Spotts H, Zgierska AE, Lennon RP (2021) COVID-19 outcomes among adult patients treated with long-term opioid therapy for chronic non-cancer pain in the USA: a retrospective cohort study. *BMJ Open* 11:e056436. <https://doi.org/10.1136/bmjopen-2021-056436>
- Wang QQ, Kaelber DC, Xu R, Volkow ND (2021) COVID-19 risk and outcomes in patients with substance use disorders: analyses from electronic health records in the United States. *Mol Psychiatry* 26:30–39. <https://doi.org/10.1038/s41380-020-00880-7>
- Lee SW, Yang JM, Moon SY et al (2021) Association between mental illness and COVID-19 in South Korea: a post-hoc analysis. *Lancet Psychiatry*. [https://doi.org/10.1016/S2215-0366\(21\)00043-2](https://doi.org/10.1016/S2215-0366(21)00043-2)
- Monnig MA, Treloar Padovano H, Sokolovsky AW et al (2021) Association of substance use with behavioral adherence to centers for disease control and prevention guidelines for COVID-19 mitigation: cross-sectional web-based survey. *JMIR Public Health Surveill* 7:e29319. <https://doi.org/10.2196/29319>
- Tzur Bitan D, Kridin K, Givon-Lavi N et al (2022) COVID-19 booster vaccination among individuals with schizophrenia in Israel. *JAMA Psychiat*. <https://doi.org/10.1001/jamapsychiatry.2022.0382>
- Fond G, Tinland A, Boucekine M et al (2020) Improving the treatment and remission of major depression in homeless people with severe mental illness: the multicentric French Housing First (FHF) program. *Prog Neuropsychopharmacol Biol Psychiatry* 99:109877. <https://doi.org/10.1016/j.pnpbp.2020.109877>
- Fond G, Boyer L, Boucekine M et al (2019) Illness and drug modifiable factors associated with violent behavior in homeless people with severe mental illness: results from the French Housing First (FHF) program. *Prog Neuropsychopharmacol Biol Psychiatry* 90:92–96. <https://doi.org/10.1016/j.pnpbp.2018.11.006>