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Factors Associated With Posttraumatic Stress Symptoms 3 and 6 Months After Hospitalization for COVID-19:
A Longitudinal Multicenter Study

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ABSTRACT

Objective: To identify factors associated with posttraumatic stress symptoms (PTSS) 3 and 6 months after the discharge of patients hospitalized for COVID-19.

Methods: Patients hospitalized for COVID-19 between March 1 and July 31, 2020, were included in a longitudinal study. Clinical assessments were conducted with online auto-questionnaires. PTSS were assessed with the Posttraumatic Stress Disorder Checklist Scale (PCLS). We screened for several putative factors associated with PTSS, including socio-demographic status, hospitalization in an intensive care unit, history of psychiatric disorder, the Hospital Anxiety and Depression Scale, the Peritraumatic Dissociative Experiences Questionnaire, and the home-to-hospital distance. Bivariate and multilinear regression analyses were performed to evaluate their association with PTSS.

Results: 119 patients were evaluated 3 months after hospital discharge, and a subset of 94 were evaluated 6 months after discharge. The prevalence of PTSS was 31.9% after 3 months and 30.9% after 6 months. Symptoms of anxiety and depression and history of psychiatric disorder were independently associated with PTSS. Additionally, dissociative experiences during hospitalization ($\beta = 0.35$; $P < .001$) and a longer home-to-hospital distance ($\beta = 0.07$; $P = .017$) were specifically associated with PTSS 3 and 6 months after discharge, respectively.

Conclusions: Patients with COVID-19 showed persistent high scores of PTSS up to 6 months after discharge from the hospital. In this specific pandemic setting, PTSS were associated with high rates of dissociative experiences during hospitalization and a longer home-to-hospital distance due to the saturation of health care facilities. These results can foster early identification and better prevention of PTSS after hospitalization for COVID-19.

Trial Registration: ClinicalTrials.gov identifier: NCT04362930

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The outbreak of the COVID-19 pandemic has thrown the world into a major health crisis. Health consequences for infected individuals can be dramatic during the acute phase of the infection and in the longer term. Infected individuals for whom hospitalization was required exhibited a wide range of symptoms that persisted after discharge, both physical[1] and psychological.[2] In particular, posttraumatic stress symptoms (PTSS) seemed highly prevalent. One month after discharge, between 12.2% and 28% of infected patients were found with above-threshold levels of PTSS.[3–6] Further cross-sectional studies showed that PTSS were found in 10%–36.4% of hospitalized patients 2 to 4 months after discharge.[7–13] A handful of studies suggested that PTSS decreased over the longer term, affecting 9.5%–19.9% of SARS-CoV-2 infected patients 6 months after discharge.[14,15] However, this still needs further assessment, and factors associated with PTSS after hospitalization for COVID-19 have to be further explored in longitudinal studies.[16–19]

A wide range of factors may increase the risk for developing PTSS after hospitalization for COVID-19. Female gender[11–14,20] and younger age[20] were reported to associate with PTSS. Previous medical history of psychiatric disorder,[3,11,12] obesity,[12] and hospitalization in an intensive care unit (ICU)[15,21] were also associated with greater risk of PTSS, although the latter association was not reported in all studies.[10,22] Persisting physical symptoms after discharge were also associated with a greater risk for PTSS.[11,15]

Several other factors specifically associated with COVID-19 may have played a crucial role in the development of PTSS after hospitalization. COVID-19 carries a higher risk of agitation and delirium[23] due to several factors, presumably including the severity of the infection and the neurotropism of SARS-CoV-2.[24,25] Subsequently, higher doses of sedative drugs were needed for mechanical ventilation.[26] Altogether, this may have led patients to have more dissociative experiences during hospitalization, such as

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Clinical Points

- Symptoms of posttraumatic stress after hospitalization for COVID-19 are frequent but still poorly investigated.
- Greater attention to symptoms of dissociation during hospitalization, symptoms of anxiety and depression, and long home-to-hospital distances may help clinicians better prevent and treat posttraumatic stress symptoms in patients hospitalized for COVID-19.

confusion, temporal distortions, impairments of bodily awareness, or derealization. In previous studies, these peritraumatic dissociative experiences correlated with the later development of PTSS.[27–29] For example, dissociative experiences during hospitalization in an ICU increased later PTSS, irrespective of why patients were admitted,[30,31] while a good sense of coherence during hospitalization diminished later PTSS,[32] especially for patients in ICU.[33] One study reported that 44.9% of patients hospitalized with COVID-19 had high peritraumatic dissociative experiences, which were associated with more PTSS 3 months later.[34] This may have important implications for treatment since it was proposed that early cognitive and behavioral therapy targeting peritraumatic dissociative experiences decreased the later development of PTSS.[35]

Another characteristic of COVID-19 was related to the very rapid spread of the virus that overwhelmed hospitals and health care facilities. Many patients had to be sent to hospitals far from their homes, either because hospitals in the vicinity were not specialized enough or because all of the wards were saturated. For example, during the first wave of COVID-19, many ICUs were full in France, and dozens of patients were transported to hospitals located hundreds of kilometers away from their homes. This may have caused particular distress for patients and their relatives and friends, increasing the risk for eventual PTSS.

In this study, we longitudinally assessed putative factors associated with PTSS 3 and 6 months after the hospital discharge of patients with COVID-19, focusing on factors specifically associated with the pandemic, particularly peritraumatic dissociative experiences during hospitalization and the home-to-hospital distance.

METHODS

Study Design

A longitudinal multicenter study explored factors associated with PTSS 3 and 6 months after hospitalization for COVID-19.

Settings

Patients hospitalized for COVID-19 between March 1 and July 31, 2020 (first wave) in the departments of Internal Medicine and Infectious Disease at the Pitié-Salpêtrière Hospital and of Pneumology at the Tenon Hospital, both in Paris, France, were contacted for inclusion. Longitudinal data were collected from June 3 to December 31, 2020. Records were part of a larger study investigating COVID-19 neurologic and psychiatric symptoms that received the approval of the Sorbonne University Ethics Committee (N°2020 CER-202028) and was registered on the ClinicalTrials.gov website (NCT04362930).

Participants

All adult patients with a laboratory-confirmed diagnosis of COVID-19 were eligible for inclusion. Data were collected at 2 time-points: 3 and 6 months after the discharge from the hospitalization for COVID-19. Non-inclusion criteria were no answer, nonacceptance, death, and incomplete or improper filling of questionnaires. Only patients included 3 months after discharge were contacted for the second assessment.

Variables

We tested 11 variables of interest. They included socio-demographic data (age, gender, home-to-hospital distance) and whether participants had been admitted to an ICU during their hospitalization for COVID-19. History of any psychiatric disorder (depression disorder, anxiety disorder, posttraumatic stress disorder [PTSD], etc) and ongoing psychotropic medication and daily drug use were also assessed. Further assessments included 3 self-completed online questionnaires as follows. The Hospital Anxiety and Depression Scale (HAD)[36] assessed symptoms of anxiety and depression (7 items each) experienced during the last week. A score greater than or equal to 8 suggested significant depressive (HAD depression) or anxiety (HAD anxiety) symptoms. The Peritraumatic Dissociative Experiences Questionnaire (PDEQ)[37,38] assessed dissociative experiences during the hospitalization for COVID-19. It consisted of 10 items rated from 1 (less severe) to 5 (more severe). A sum greater than or equal to 15 suggested peritraumatic dissociation. Lastly, the Posttraumatic Stress Disorder Checklist Scale (PCLS)[39,40] screened for PTSS over the last month. Patients were prompted to complete the PCLS in relation to their hospitalization for COVID-19. Any event occurring during the hospitalization could have occasioned PTSS, including life-threatening physical symptoms, fears of death, transfer to ICU, etc. Seventeen items were rated from 1 (less severe) to 5 (more severe). A sum greater than or equal to 34 suggested posttraumatic stress syndrome.

Data Sources/Measurement

Socio-demographic data and the history of psychiatric disorder were collected from medical reports. The proposed diagnosis was verified with *DSM-5* criteria when relevant information was found. The home-to-hospital distance was computed as the straight-line distance between the GPS localization of the hospital and patients' postal addresses as indicated in their medical reports. Anonymized online information was recorded via QUALTRIX (https://www.qualtrics.com), user-friendly software for online data collection. Patients self-completed auto-questionnaires (PDEQ, HAD, PCLS) and self-reported information about

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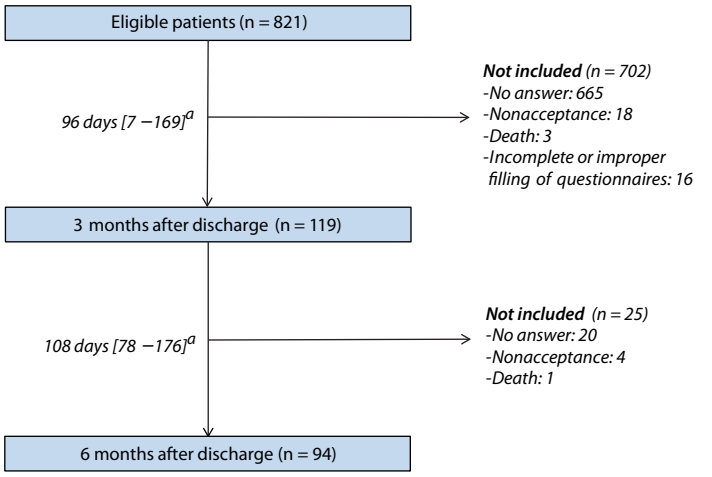
Figure 1. Flowchart of Inclusion in the Study



[a]Mean [range] number of days between assessments.

their ongoing psychotropic medication and drug use 3 months after discharge. Patients completed again only the HAD and PCLS auto-questionnaires and self-reported updated data regarding psychotropic medication and drug use 6 months after discharge.

Bias

Both La Pitié-Salpêtrière and Tenon are public hospitals in which patients are not selected on their sociodemographic status. Furthermore, all patients hospitalized for COVID-19 were contacted indistinctively. This helped to control for a potential selection bias. Patients were approached several times in order to address a potential nonresponse bias due to low response rate or dropout between the 2 assessments. They were first approached by e-mail twice. When no answer could be obtained, patients were contacted by phone by a mental health specialist (W.C. or A.H.) who provided further details about the study. If patients wished to participate but had technical difficulties or were reluctant to self-complete questionnaires online, they could fill them in with the help of a mental health specialist (A.H.) either on the phone or during a consultation at the hospital. Lastly, we compared scores of patients completing PDEQ after a shorter versus a longer delay after discharge (median split, *t* test) to address a potential recall bias due to assessing dissociative symptoms after discharge.

Study Size

We calculated the study size based on expected results of the PDEQ and HAD (anxiety and depression) questionnaires and their association with PTSS 3 and 6 months after hospitalization in multilinear regression analyses. In line with previous literature,[28,29] we expected a medium effect size (f^2 = 0.15). Given that patients hospitalized with COVID-19 were much solicited for other studies, and that our studies involved multiple assessments that could discourage patients, we expected the response rate to be 20% 6 months after discharge. We used the software G Power 3.1 to estimate a priori that a minimum of 590 patients hospitalized for COVID-19 had to be contacted in order to assess 10 predictors for the PCLS considering a power of 80% and an α risk of 5%.

Statistical Methods

Descriptive data were reported with mean, standard deviation, and 95% confidence interval when continuous and with number and percentage when categorical. Study values normality was verified using normal probability plots. A Student *t* test was used for continuous variables and a χ^2 test for categorical variables to compare samples responding to assessments 3 months after discharge only versus 3 and 6 months after discharge. Pearson bivariate analyses investigated the factors associated with PTSS 3 and 6 months after hospital discharge. Independent variables with a *P* value lower than 0.1 in bivariate analyses were introduced in a multivariable stepwise linear regression analysis. Multicollinearity was assessed with variance inflation factor (VIF). Zero-order and partial correlations were reported for each significant variable in the multivariable linear regression. Normality of residuals values was verified using normal probability plots. Cronbach α values were calculated to assess the internal consistency of questionnaires. All tests were 2-tailed, and the significance level was set at α = .05. All analyses were run with IMB Statistical Package for Social Sciences (SPSS) 11.0, released in 2002.

RESULTS

Descriptive Analysis

Among 821 eligible patients, 119 (14%) participated 3 months after hospital discharge (Figure 1). Reasons for non-inclusion (702) were no possible contact by email or phone (665), nonacceptance (18), death (3), or incomplete or improper filling out of questionnaires (16). A subset of 94 (11.5%) patients filled out the questionnaires 6 months

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Table 1. Descriptive Analyses

	3 Months after discharge (n = 119)	6 Months after discharge (n = 94)	*P* value for *t* tests comparing samples included 3 months and 6 months after discharge
Age, y, mean (SD) [95% CI]	61.2 (15.8) [25 to 95]	61.9 (15.9) [25 to 95]	.99
Gender, female, n (%)	48 (40.3)	36 (38.3)	.56
History of psychiatric disorder, n (%)	39 (32.8)	31 (33.0)	.22
Psychotropic medication, n (%)[a]	15 (12.6)	10 (10.6)	.31
Daily drug use, n (%)[a]			.36
Alcohol	22 (18.5)	20 (21.3)	
Other	4 (3.4)	0	
Home-to-hospital distance			.82
Distance, km, mean (SD) [95% CI]	10.0 (34.4) [0.6 to 320.7]	10.7 (38.3) [0.6 to 320.7]	
<1 km, n (%)	27 (22.7)	26 (27.7)	
1–5 km, n (%)	54 (45.4)	43 (45.7)	
5–10 km, n (%)	18 (15.1)	10 (10.6)	
> 10 km, n (%)	20 (16.8)	15 (16.0)	
Hospitalization in ICU, n (%)	54 (45.4)	44 (46.8)	.95
PCLS			.58
≥ 34, n (%)	38 (31.9)	29 (30.9)	
Scores, mean (SD) [95% CI]	29.6 (11.9) [17 to 62]	30.4 (13.0) [17 to 67]	
PDEQ			.95
≥ 15, n (%)	70 (58.5)		
Scores, mean (SD) [95% CI]	17.7 (8.6) [10 to 41]		
HAD anxiety			.24
≥ 8, n (%)	37 (31.1)	30 (31.9)	
Scores, mean (SD) [95% CI]	6.5 (3.8) [0 to 17]	6.0 (3.9) [0 to 18]	
HAD depression			.44
≥ 8, n (%)	22 (18.5)	27 (28.7)	
Scores, mean (SD) [95% CI]	4.1 (3.6) [0 to 13]	4.6 (4.2) [0 to 16]	

[a]At the time of the assessment.
Abbreviations: HAD = Hospital Anxiety and Depression scale, ICU = intensive care unit, PCLS = Posttraumatic Stress Disorder Checklist Scale, PDEQ = Peritraumatic Dissociative Experiences Questionnaire.

after hospital discharge. Reasons for non-inclusion (25) were no possible contact by email or phone (20), nonacceptance (4), or death (1). All included patients self-completed the questionnaires online 3 months after discharge, while 6 months after discharge 24% (23) completed the questionnaires with the help of the mental health specialist (A.H.), either on the phone (22) or at the hospital (1). Four departments of hospitalization were homogeneously represented in patients completing questionnaires 3 and 6 months after discharge (31, 18, 48, 22 and 22, 15, 36, 21, respectively, in the Department of Internal Medicine 1, Pitié-Salpêtrière; the Department of Internal Medicine 2, Pitié-Salpêtrière; the Department of Infectious Diseases, Pitié-Salpêtrière; and the Department of Pneumology, Tenon).

Socio-demographic and clinical data are shown in Table 1. There were no significant differences between the samples of patients taking part in only 1 or 2 assessments, ie, filling questionnaires 3 months after discharge or 3 months and 6 months after discharge (Student *t* test or χ^2 test; $P > .05$), except for higher HAD depression scores in patients not included 6 months after discharge ($t = -2.74$, $P = .01$). Participants taking part in both assessments were mostly men (61.7%) in the second half of life (mean [SD] = 61.9 [15.9]; range, 25–95 years old). About a third of them (33%) had a medical history of psychiatric disorder before the infection, and 10.6% took psychotropic medication at the time of assessments. Additionally, 21.3% of patients declared daily alcohol use. Almost half of the patients (46.8%) were admitted to ICU during their hospitalization for COVID-19.

Regarding the home-to-hospital distance, 27.7% of patients lived less than 1 km away from the hospital, 45.7% lived between 1 and 5 km away, 10.6% lived between 5 and 10 km away, and 16% lived further than 10 km away.

In clinical assessments, 31.9% and 30.9% of patients were quoted above the threshold at PCLS 3 and 6 months after discharge. Many patients also reported high levels of anxiety (31.1% above threshold) and depression (18.5% above threshold) 3 months after discharge, which tended to increase 6 months after discharge (31.9% and 28.7% above the threshold, respectively), although this was not significant ($P > .05$). A majority of patients (58.5%) reported dissociative experiences during hospitalization. There was no difference between scores of PDEQ completed after a shorter versus a longer delay after discharge ($t = 1.14$, $P = .26$). Cronbach α values for questionnaires 3 and 6 months after discharge were high to very high (PDEQ = .91; HAD = .87 and .88, respectively; PCLS = .92 and .93, respectively).

Factors Associated With PTSS 3 Months After Hospital Discharge

Pearson bivariate analyses (Table 2) showed that younger age ($P = .016$), female gender ($P = .01$), medical history of psychiatric disorder ($P = .007$), and psychotropic medication use ($P = .001$) were associated with more PTSS 3 months after hospital discharge. High scores of depression (HAD depression) and anxiety (HAD anxiety), as well as peritraumatic dissociative experiences during hospitalization (PDEQ), were also associated with more PTSS ($P < .001$).

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Table 2. Bivariate Analyses

	PCLS 3 months after discharge (n = 119)[a]	PCLS 6 months after discharge (n = 94)[a]
Age	*R* = –0.220 ***P* = .016**	*R* = –0.124 *P* = .234
Gender, female	*R* = 0.235 ***P* = .010**	*R* = 0.121 *P* = .246
History of psychiatric disorders	*R* = 0.247 ***P* = .007**	*R* = 0.189 *P* = .067
Psychotropic medication[b]	*R* = 0.304 ***P* = .001**	*R* = 0.161 *P* = .120
Daily drug use[b]	*R* = –0.069 *P* = .453	*R* = –0.115 *P* = .271
Home-to-hospital distance	*R* = 0.045 *P* = .668	*R* = 0.230 ***P* = .033**
Hospitalization in ICU	*R* = –0.103 *P* = .264	*R* = 0.096 *P* = .355
PDEQ	*R* = 0.580 ***P* < .001**	*R* = 0.432 ***P* < .001**
HAD anxiety 3 months after discharge	*R* = 0.727 ***P* < .001**	*R* = 0.558 ***P* < .001**
HAD anxiety 6 months after discharge	…	*R* = 0.782 ***P* < .001**
HAD depression 3 months after discharge	*R* = 0.739 ***P* < .001**	*R* = 0.508 ***P* < .001**
HAD depression 6 months after discharge	…	*R* = 0.779 ***P* < .001**
PCLS 3 months after discharge	…	*R* = 0.577 ***P* < .001**

[a]Boldface indicates *P* < .05.
[b]At the time of the assessment.
Abbreviations: HAD = Hospital Anxiety and Depression Scale, ICU = intensive care unit, PCLS = Posttraumatic Stress Disorder Checklist Scale, PDEQ = Peritraumatic Dissociative Experiences Questionnaire.

Among those factors, the multilinear regression analysis isolated 4 independent factors associated with PTSS 3 months after discharge (Table 3): symptoms of depression (β = 1.22, 95% CI [0.83 to 1.62]), symptoms of anxiety (β = 1.15, 95% CI [0.75 to 1.54]), peritraumatic dissociative experiences (β = 0.35, 95% CI [0.19 to 0.50]), and history of psychiatric disorder (β = 2.49, 95% CI [–0.016 to 4.99]). Multicollinearity (VIF) was low for all variables (HAD anxiety = 1.69; HAD depression = 1.68; PDEQ = 1.29; history of psychiatric disorder = 1.03).

Factors Associated With PTSS 6 Months After Hospital Discharge

Six months after discharge, bivariate analyses showed that the home-to-hospital distance (*P* = .033), symptoms of depression and anxiety assessed 3 and 6 months after discharge (*P* < .001), peritraumatic dissociative experiences during hospitalization (*P* < .001), and PTSS 3 months after discharge (*P* < .001) were associated with more PTSS (see Table 2).

Considering only late factors (ie, excluding auto-questionnaires assessed 3 months after discharge), the multilinear regression showed that symptoms of anxiety (β = 1.62; 95% CI [1.17 to 2.07]), symptoms of depression (β = 1.40, 95% CI [0.99 to 1.81]), and the home-to-hospital distance (β = 0.07, 95% CI [0.04 to 0.11]) were significantly associated with PTSS. Multicollinearity (VIF) was low for all variables (HAD anxiety = 1.75; HAD depression = 1.76; PDEQ = 1.29; history of psychiatric disorder = 1.01).

Considering early factors only (ie, excluding auto-questionnaires assessed 6 months after discharge), PTSS 6 months after hospital discharge were associated with PTSS 3 months after discharge (β = 0.38, 95% CI [0.23 to 0.65]), the home-to-hospital distance (β = 0.07, 95% CI [0.01 to 0.12]), and symptoms of anxiety (β = 1, 95% CI [0.18 to 1.82]). Multicollinearity (VIF) was low for all variables (PCLS = 2.24; home-to-hospital distance = 1.00; HAD anxiety = 2.24).

DISCUSSION

We showed that up to one-third of patients hospitalized for COVID-19 exhibited above threshold PTSS 3 and 6 months after discharge. PTSS seem frequent after hospitalization for COVID-19 and remain stable over time. Our data thereby complement and go beyond previous reports by Horn et al[21] in similar health care settings in France. Contrary to previous reports, though,[14,15] our results suggest that high rates of PTSS persist 6 months after discharge. This is in line with meta-analyses showing that hospitalizations for other coronavirus infections led to PTSS in 32.2%[41] to 39%[42] of patients over the long run.

Our results suggest particularly high rates of PTSS after COVID-19. In comparison, meta-analyses showed that PTSS occurred in 25% of patients 3 months after discharge from ICU, regardless of why they were admitted.[43–45] Furthermore, our results point toward several factors associated with PTSS after hospitalization for COVID-19, including peritraumatic dissociative experiences, symptoms of anxiety and depression, history of psychiatric disorders, and home-to-hospital distance. Peritraumatic dissociative experiences are specifically associated with PTSS 3 months after discharge, while a longer home-to-hospital distance is specifically associated with PTSS 6 months after discharge. This suggests that the factors associated with PTSS may vary over the time after hospitalization. Several other factors identified in previous studies (eg, female gender,[11–14,20] younger age,[20] psychotropic medication, and hospitalization in ICU[15,21]) were associated with PTSS in bivariate analyses, but they did not remain significant in the multivariate regression analysis.

Strong correlations were shown between symptoms of depression and anxiety and PTSS. These findings confirm previous ones in larger samples before the outbreak of the COVID-19 pandemic.[46,47] However, in our study, multivariate regression analyses showed that symptoms of anxiety and depression are independently associated with PTSS. This suggests that symptoms of anxiety and depression and PTSS only partially overlap. This is in line with a recent meta-analysis of neuroimagery data suggesting that anxiety, depression, and PTSS have somewhat distinct neural bases.[48]

More than 50% of patients with COVID-19 reported high dissociative experiences during hospitalization, which was associated with PTSS 3 months after discharge. Besides the specific neurotropism of SARS-CoV2[24,25] that may have favored dissociative experiences during hospitalization, one

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Table 3. Multivariate Regression Analyses

Predictors of PCLS 3 months after discharge[a]								
Independent variables (3 months after discharge)	Unstandardized β [95% CI]	Standardized β	*T* test	*P* value	Adjusted R^2	Zero-order *R*	Partial-order *R*	VIF
Model 1								
(Constant)	20.00 [17.70 to 23.30]		17.37	<.001				
HAD depression	2.29 [1.90 to 2.68]	0.74	11.87	<.001	0.54	0.74	0.74	1.00
Model 2								
(Constant)	14.63 [12.06 to 17.20]		11.38	<.001				
HAD depression	1.46 [1.04 to 1.88]	0.47	6.98	<.001		0.74	0.54	1.59
HAD anxiety	1.36 [0.95 to 1.78]	0.44	6.53	<.001	0.66	0.73	0.52	1.59
Model 3								
(Constant)	10.49 [7.49 to 13.49]		7.00	<.001				
HAD depression	1.25 [0.85 to 1.64]	0.40	6.29	<.001		0.74	0.51	1.68
HAD anxiety	1.16 [0.77 to 1.56]	0.38	5.87	<.001		0.73	0.48	1.68
PDEQ	0.36 [0.20 to 0.52]	0.25	4.54	<.001	0.71	0.58	0.39	1.28
Model 4								
(Constant)	10.08 [7.10 to 13.07]		6.75	<.001				
HAD depression	1.22 [0.83 to 1.62]	0.40	6.23	<.001		0.74	0.50	1.69
HAD anxiety	1.15 [0.75 to 1.54]	0.37	5.86	<.001		0.73	0.48	1.68
PDEQ	0.35 [0.19 to 0.50]	0.25	4.42	<.001		0.58	0.38	1.29
History of psychiatric disorders	2.49 [–0.016 to 4.99]	1.00	1.99	.049	0.72	0.25	0.18	1.03
Late predictors of PCLS 6 months after discharge (excluding auto-questionnaires assessed 3 months after discharge)[b]								
Independent variables (6 months after discharge)	Unstandardized β [95% CI]	Standardized β	*T* test	*P* value	Adjusted R^2	Zero-order *R*	Partial-order *R*	VIF
Model 1								
(Constant)	14.52 [11.39 to 17.65]		9.29	<.001				
HAD anxiety	2.64 [2.20 to 3.08]	0.78	12.03	<.001	0.61	0.78	0.78	1.00
Model 2								
(Constant)	14.07 [11.48 to 16.70]		10.84	<.001				
HAD anxiety	1.61 [1.13 to 2.09]	0.48	6.67	<.001		0.78	0.36	1.75
HAD depression	1.44 [1.00 to 1.88]	0.47	6.54	<.001	0.73	0.78	0.35	1.75
Model 3								
(Constant)	13.46 [11.01 to 15.91]		11.33	<.001				
HAD anxiety	1.62 [1.17 to 2.07]	0.47	7.20	<.001		0.78	0.60	1.75
HAD depression	1.40 [0.99 to 1.81]	0.45	6.83	<.001		0.78	0.59	1.76
Home-to-hospital distance	0.07 [0.037 to 0.11]	0.20	3.79	<.001	0.77	0.27	0.39	1.01
Early predictors of PCLS 6 months after discharge (excluding auto-questionnaires assessed 6 months after discharge)[c]								
Independent variables (3 months after discharge)	Unstandardized β [95% CI]	Standardized β	*T* test	*P* value	Adjusted R^2	Zero-order *R*	Partial-order *R*	VIF
Model 1								
(Constant)	11.67 [5.73 to 17.61]		3.93	<.001				
PCLS	0.63 [0.45 to 0.82]	0.58	6.78	<.001	0.33	0.58	0.57	1.00
Model 2								
(Constant)	11.24 [5.43 to 17.06]		3.87	<.001				
PCLS	0.63 [0.44 to 0.80]	0.57	6.83	<.001		0.58	0.59	1.00
Home-to-hospital distance	0.07 [0.01 to 0.12]	0.19	2.33	.003	0.36	0.27	0.31	1.00
Model 3								
(Constant)	11.87 [6.183 to 17.56]		4.17	<.001				
PCLS	0.38 [0.12 to 0.65]	0.35	2.88	.005		0.58	0.30	2.24
Home-to-hospital distance	0.07 [0.01 to 0.12]	0.20	2.44	.017		0.27	0.32	1.00
HAD anxiety	1.00 [0.18 to 1.82]	0.29	2.43	.017	0.41	0.56	0.25	2.24

[a]Model 1: $F = 140.90$; $P < .001$. Model 2: $F = 116.89$; $P < .001$. Model 3: $F = 97.94$; $P < .001$. Model 4: $F = 76.32$; $P = .049$.
[b]Model 1: $F = 144.74$; $P < .001$. Model 2: $F = 126.63$; $P < .001$. Model 3: $F = 101.56$; $P < .001$.
[c]Model 1: $F = 46.00$; $P < .001$. Model 2: $F = 26.84$; $P = .003$. Model 3: $F = 20.81$; $P = .017$.
Abbreviations: HAD = Hospital Anxiety and Depression scale, PCLS = Posttraumatic Stress Disorder Checklist Scale, PDEQ = Peritraumatic Dissociative Experiences Questionnaire, VIF = variance inflation factor.

may suggest that the specific context of the pandemic largely also contributed.[49] A lockdown was ongoing in France from March 17 to May 11, 2020, forbidding travels further than 1 kilometer around the home. People had to stay home and could not visit their relatives and friends at the hospital, even if severely sick. This led to the major social isolation of hospitalized patients, disrupting patients' strategies to cope with distress.

When confronted with highly distressing events such as hospitalization, each appeals to a series of protective psychological stances, among which interpersonal relationships, self-esteem, and positive beliefs about the world play an important role.[50] Patients hospitalized with COVID-19 found themselves particularly isolated, facing high uncertainty about the future and the fear that their beloved ones may also become infected. This higher distress may have resulted in more difficulties coping with the hospitalization, leading to a greater risk for dissociate experiences. Thus, it was shown that social isolation could foster agitation and delirium during hospitalization[51,52] and

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associate with more PTSS after the discharge[6,53] while social support decreases the risk for PTSS.[5,6,20] Lastly, some data suggest that PTSS might also have arisen among patients' relatives and friends,[6] especially when the patients were admitted to ICU.[54] This may have affected COVID-19 patients in return.

Although only 6 months after discharge, home-to-hospital distance was another independent factor associated with PTSS. Of note, the home-to-hospital distance increased during the pandemic. There are 5 and 9 hospitals with ICU facilities within the 5 km around the 2 hospitals considered in this study (Tenon and Pitié-Salpêtrière, respectively). However, in our data, 25% of patients were hospitalized more than 5 km away from home and 15%, more than 10 km away. One patient even lived 320.7 km away from the hospital. Thus, patients with COVID-19 were hospitalized further away from their homes than they would have been in a non-pandemic context, as health care facilities were oversaturated during the first pandemic wave. These longer home-to-hospital distances may have favored PTSS in several ways. First, there is evidence that patients living far away from hospitals tend to visit fewer emergency departments.[55] A 10-km increase in straight-line distance between home and hospital was associated with a 1% absolute increase in mortality when patients were in potentially life-threatening conditions.[56] Therefore, faraway patients may arrive at the hospital with more severe symptoms, leading to more PTSS after hospitalization. A recent meta-analysis also reported that a longer home-to-hospital distance is associated with longer hospital stays,[57] which may favor PTSS after discharge.

Nevertheless, the most important reason the home-to-hospital distance can favor PTSS after hospitalization is poorer psychological and medical care for patients after hospital discharge. One may assume that patients living further away from the hospital had more difficulties returning to the hospital for appropriate follow-up, especially in the specific context of lockdowns and travel restrictions due to the pandemic. In contrast with patients living near the hospital, those living far away may have less benefit from specialized care after hospitalization, particularly psychological or psychiatric help, thereby increasing the risk for PTSS in the longer term after discharge.[58] This might explain why longer home-to-hospital distances correlated with PTSS only 6 months but not 3 months after discharge. This hypothesis is in line with previous reports suggesting that outpatient cardiac rehabilitation after hospitalization for severe cardiac diseases was less attended by patients living further away from the hospital.[59]

Results reported in this study might lead to significant improvements for prevention and treatment of PTSS after hospitalization for COVID-19. Every discharged patient should be screened systematically for risk factors of PTSS given the high rates of PTSS after hospitalization for COVID-19. Dedicated prevention and therapeutic tools may be used. Specifically, early cognitive and behavioral therapy might be efficient during the hospitalization or soon after to prevent PTSS.[30]

Alongside with mental health professionals, physicians and somatic health professionals should also be more informed about risks for PTSS after hospitalization for COVID-19 and associated factors. After this study, a dedicated screening protocol was proposed to both hospitals involved in this study, in collaboration with their departments of consultation-liaison psychiatry. Therewith, systematic screening for factors associated with PTSS, including dissociative experiences during the hospitalization and long home-to-hospital distance, helps with identifying patients to be referred to a mental health specialist.

Lastly, health care administrators should also aim at reducing risks for PTSS after hospitalization for COVID-19. In the future, it seems important to evaluate how to promote short home-to-hospital distances. If the hospitalization must be far away from home, it may be useful to provide specific medical care, for example organizing home visits and greater psychological support.

Limitations

One limitation of our study comes from our evaluation of PTSS. Although the PCLS questionnaire showed good rates of sensibility and specificity,[40] it shall not be taken as providing a clinical diagnosis of PTSD for which a medical interview is needed. Further studies should therefore aim at confirming the present results with patients clinically evaluated by a mental health specialist.

Another limitation of this work is the limited sample size and the high rate of patients hospitalized for COVID-19 that did not enter the study, which may limit the generalizability of our findings. One should note, however, that response rates were also low in other longitudinal studies with patients hospitalized with COVID-19.[9,14,15] One reason for this might be that many patients were elderly, thereby facing difficulties completing online questionnaires. Another explanation for not entering our survey may be that patients with COVID-19 were solicited for many clinical studies.

Overall, results reported in this study need to be replicated with larger and more representative samples of patients hospitalized for COVID-19. Future studies could advantageously include additional factors that might be associated with PTSS but were not assessed in the present study, including lack of social support, symptoms of delirium during the hospitalization, and persistent disability after the hospitalization.

CONCLUSIONS

We showed that PTSS occur in nearly one-third of patients hospitalized for COVID-19. After discharge, factors associated with PTSS include anxiety symptoms, depression, and a history of psychiatric disorder. Additionally, dissociative experiences during hospitalization and a longer home-to-hospital distance were associated with PTSS 3 and 6 months after discharge, respectively. Clinicians should consider those factors for better prevention and early treatment of PTSS in patients discharged after COVID-19 hospitalization.

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