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Risk of post-traumatic stress symptoms in hospitalized and non-hospitalized COVID-19 recovered patients. A cross-sectional study

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ABSTRACT

High rates of post-traumatic stress disorder (PTSD) symptoms have been found among patients with more severe COVID-19-related symptoms, and hospitalization is generally recognized as a risk factor for developing PTSD. Furthermore, other personality characteristics may increase the risk of developing post-traumatic stress symptoms following a COVID-19 infection. This study aimed to assess personality traits, alexithymia, dissociation, anxiety, and depression in patients who have recovered from COVID-19 and the impact of these variables on the presence of post-traumatic stress symptoms. Five hundred and six participants completed a battery of standardized questionnaires. All the scales used in this study are valid and reliable measures of their respective constructs. Results showed that high levels of alexithymia, dissociation, anxiety, and depression statistically significantly predicted the three main clusters of PTSD symptoms (avoidance, intrusion, and hyperarousal) in individuals who have recovered from COVID-19. Furthermore, negative affectivity and psychoticism significantly predicted PTSD symptoms in our sample. Finally, individuals hospitalized by COVID-19 are more at risk of developing intrusion and hyperarousal symptoms than those who never needed hospital care. Our findings are a valuable contribution in identifying the main risk factors of psychological distress related to COVID-19 to address the long-term mental health needs of people who have experienced the disease.

1. Introduction

The coronavirus disease (COVID-19) is an infection caused by the novel beta-coronavirus SARS-CoV-2, which was discovered in December 2019 and then spread rapidly from China throughout the world (World Health Organization, 2020a, 2020b). To date, the COVID-19 pandemic has affected all countries worldwide. Some 191 million people have been infected with the virus, and the number of deaths worldwide has reached 4.1 million (Statista, 2021d).

COVID-19 is associated with different levels of disease severity, including asymptomatic infection, mild, moderate, severe, and critical disease (Gao et al., 2021; National Institutes of Health, 2021). Mild patients only show minor symptoms without imaging features of pneumonia. Moderate patients present respiratory symptoms with imaging features of pneumonia. Severe and critical patients exhibit serious respiratory impairment and multi-organ complications (National Institutes of Health, 2021; Wang et al., 2020).

The spread of the coronavirus in Italy, the context of this study, started in February 2020. Italy was the first European country to face the COVID-19 pandemic. To date, approximately 4.3 million Italians have been affected by COVID-19, and 127,884 people have died. As of July 23, 2021, the number of subjects in Italy currently positive for COVID-19

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infection in Italy was 49,310 (Statista, 2021c). Among these, 156 infected individuals were treated in intensive care units (ICU) (Statista, 2021a), another 1.1 thousand individuals infected were hospitalized with symptoms, and almost 45 thousand were in isolation at home (Statista, 2021d). Nevertheless, most people who contracted COVID-19 have recovered. To date, the number of individuals who recovered from coronavirus in Italy exceeds 4 million (Statista, 2021b).

The COVID-19 pandemic and the many restrictions it imposed on personal and social life continue to impact people's lives significantly and, in particular, their mental health. Indeed, it has been amply demonstrated that many consequences of the virus spreading, such as social isolation, uncertainty, physical discomfort, medication side effects, and fear of virus transmission to others, have been associated with adverse mental health outcomes, including, but not limited to, anxiety, depression, insomnia, and post-traumatic stress symptoms (Bo et al., 2021; Gramaglia et al., 2021; Xiang et al., 2020). The psychological distress caused by COVID-19 has been reported to be higher in patients affected by the virus than those who were not (Gramaglia et al., 2021; Krishnamoorthy et al., 2020). Furthermore, as observed in previous Middle East respiratory syndrome coronavirus infection and severe acute respiratory syndrome studies (Jeong et al., 2016; Shin et al., 2019; Wing and Leung, 2012), mental health-related symptoms may persist even after recovery from the disease in the mid-and long-term (Gramaglia et al., 2021). Two recent studies reported high levels of post-traumatic stress symptoms (96.2%) and a high prevalence of depressive symptoms (29.2%) in newly recovered patients (Bo et al., 2021; Zhang et al., 2021).

The impact of COVID-19 on psychological outcomes could be related to the severity of illness. Post-traumatic stress disorder (PTSD) rates are particularly high among patients with more severe COVID-19-related symptoms (Chamberlain et al., 2021; Greenberg and Rafferty, 2021). Specifically, patients who require admission to Intensive Care Units (ICU) for treatment of acute COVID-19 are at increased risk of developing post-traumatic symptoms (Carenzo et al., 2021; Herridge et al., 2011). Indeed, it is known that traumatic experiences confronting the individual unexpectedly with death, a danger to life, or a threat to physical and mental integrity may cause difficulty regulating emotional states and tolerating negative emotions (La Rosa et al., 2021). In particular, hospitalization is generally recognized as a risk factor for developing PTSD (Sareen, 2014).

The literature has shown that some individuals are at greater risk of developing post-traumatic symptoms following traumatic events (Sareen, 2014). For example, studies on traumatized patients found a significant relationship between PTSD, emotion regulation, and dissociation (Briere, 2006; Velotti et al., 2021). Alexithymia is a condition of reduced emotional awareness and is specifically characterized by an inability to both recognize and describe emotional states, as well as by externally oriented thinking and poor imaginal processes (Craparo, 2011; Craparo et al., 2020; La Rosa et al., 2021). Research has shown that alexithymia exacerbates PTSD symptoms (Tull et al., 2007), suggesting that emotion dysregulation is a mechanism that emphasizes or makes these symptoms chronic (Velotti et al., 2021). Furthermore, alexithymia may predict dissociation, which plays an essential role in PTSD. Dissociation often occurs as a response to a traumatic event and consists of the disintegration of psychic functions with symptoms such as amnesia, experiences of detachment, and multiple personalities (La Rosa et al., 2021; Velotti et al., 2021).

The literature also highlights the role of anxiety and depression related to the experience of hospitalization as risk factors for the development of PTSD symptoms. For example, a recent study by Hatch et al. (2018) showed that more than half of the patients following treatment in ICU for critical illness reported relevant anxiety and depression symptoms, assessed through the Hospital Anxiety and Depression Scale. Furthermore, these patients report a higher risk of developing post-traumatic stress symptoms (Hatch et al., 2018).

Finally, personality characteristics can also influence an individual's response to a traumatic event. For example, individuals with less emotional stability reported more intense and lasting emotional reactions associated with a more intense perception of the impact of stressful events (Gori et al., 2021). The fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) (American Psychiatric Association, 2013a) introduced a multidimensional personality trait model based on five main personality domains (negative affect, detachment, antagonism, disinhibition, and psychoticism), which led to the development of the Personality Inventory for DSM-5 (PID-5). Several studies investigated the DSM-5 personality dimensions in individuals diagnosed with PTSD. For example, James et al. (2015) reported that the personality profile of individuals with PTSD was primarily characterized by detachment and negative affect, followed by disinhibition, psychoticism, and antagonism. Møller et al. (2021) also confirms that maladaptive personality traits assessed through the PID-5, especially negative affect, were significantly associated with PTSD symptoms.

In the light of these considerations, little is known on risk factors related to the development of post-traumatic stress symptoms in individuals who recovered from COVID-19 and who had the disease at different levels of severity. In particular, there are still few studies on the psychological impact of the experience of hospitalization on individuals cured of COVID-19.

Therefore, this study aimed to investigate the development of post-traumatic symptoms in patients recovered from COVID-19 with different levels of illness severity, individual characteristics (e.g., personality traits and alexithymia), and hospitalization experiences (e.g., dissociation, anxiety, and depression during hospitalization). We proposed that people who have experienced a more severe form of COVID-19 requiring hospitalization present higher post-traumatic symptoms than those who were not hospitalized. In addition, we expected that the risk of developing such post-traumatic symptoms is more significant in individuals who showed high levels of alexithymia, dissociation, anxiety, depression, and dysfunctional personality traits.

2. Methods

This cross-sectional, observational study was conducted between May and July 2021. Participants were deemed cured of COVID-19 with a negative swab and had undergone different treatment options for COVID-19 treatment. Subjects with previous psychiatric comorbidities and/or undergoing psychopharmacological therapy were excluded from the study sample.

A web-based survey was disseminated through the major social networks and by invitation to patients attending COVID-19 centers participating in the study. Participants completed the survey anonymously, voluntarily, and without any remuneration. An online informed consent was obtained from all study participants. The study protocol was drafted according to the standards of the Declaration of Helsinki and approved by the Ethics Committee of the Kore University of Enna.

2.1. Sample

Overall, 530 subjects answered the survey. Participants who stated that they were not affected by COVID-19 (n = 22) and who sent incomplete questionnaires (n = 2) were excluded from the sample. Therefore, the final sample included 506 subjects. 86.0% were female with a mean age of 47.18 years old (SD = 10.93, range: 15–81). Most of the sample received home therapy for the treatment of COVID-19 (72.3%), spending an average of 32.22 days (SD = 18.53, range = 0–120) in home isolation. However, a significant percentage underwent hospitalization (21%). Specifically, 12.3% underwent ordinary hospitalization, 6.3% were admitted to sub-intensive care, and 2.4% to intensive care. The average hospitalization time was 4.52 days (SD = 12.20, range = 1–118). In addition, 67.5% of the sample stated that they had experienced cases of COVID-19 in their families, and 10.7% had suffered family bereavement due to the disease.

Table 1 shows the complete sample socio-demographic characteristics.

2.2. Measures

The survey included a socio-demographic section in which the participants provided information about gender, age, education, and job. Furthermore, they were asked to indicate whether they had contracted COVID-19, what therapy they received (e.g., none as asymptomatic, home therapy, routine hospitalization, ICU hospitalization), and the presence of family members with COVID-19 and family bereavements.

Participants then completed a battery of standardized questionnaires to assess personality traits and the presence of post-traumatic stress symptoms related to COVID-19, alexithymia, dissociation, anxiety, and depression. In the following paragraphs, we described the scales used in the study.

2.2.1. Personality inventory for DSM-5 brief form (PID-5-BF)

The PID-5-BF (American Psychiatric Association, 2013b) is a 25-item self-administered scale for the assessment of five personality domains (Negative Affectivity, Detachment, Antagonism, Disinhibition, and Psychoticism), according to the DSM-5 classification (American Psychiatric Association, 2013a; Skodol et al., 2015). Each item (e.g., "People would describe me as reckless," "I feel like I act totally on impulse") was measured on a four-point Likert scale from 0 (Very false or often false) to 3 (Very true or often true). About the five personality domains, negative affect is characterized by emotional lability, anxiousness, and separation insecurity; detachment is defined by withdrawal, anhedonia, and intimacy avoidance; antagonism concerns manipulativeness, deceitfulness, and grandiosity; disinhibition concerns irresponsibility, impulsivity, and distractibility; and psychoticism is defined by unusual beliefs and experiences, and eccentricity. The Italian adaptation of the scale was used in this study (American Psychiatric Association, 2015).

Table 1
Characteristics of the sample.

Variable		Value
Gender	Female (%)	435 (86.0)
	Male (%)	71 (14.0)
Marital status	Single (%)	85 (16.8)
	Married (%)	289 (57.1)
	Live-in-partner (%)	57 (11.3)
	Separated (%)	31 (6.1)
	Divorced (%)	36 (7.1)
	Widowed (%)	8 (1.6)
Highest educational level	Primary school (%)	6 (1.2)
	Middle school (%)	70 (13.8)
	High school (%)	242 (47.8)
	Bachelor degree (%)	53 (10.5)
	Master degree (%)	89 (17.6)
	Post-graduate degree (%)	46 (9.1)
Employment	Unemployed (%)	44 (8.7)
	Seeking first employment (%)	3 (0.6)
	Student (%)	6 (1.2)
	Armed forces (%)	5 (1.0)
	Craftsman (%)	7 (1.4)
	Employee (%)	192 (37.9)
	Entrepreneur (%)	10 (2.0)
	Freelancer (%)	39 (7.7)
	Healthcare personnel (%)	86 (17.0)
	Housekeeper (%)	35 (6.9)
	Merchant (%)	10 (2.0)
	Religious (%)	1 (0.2)
	School personnel (%)	43 (8.5)
	Retired (%)	25 (4.9)
COVID-19 therapy	Asymptomatic (%)	34 (6.7)
	Domiciliary (%)	366 (72.3)
	Ordinary hospitalization (%)	62 (12.3)
	Sub-intensive care (%)	32 (6.3)
	Intensive care (%)	12 (2.4)
COVID-19 cases in the family	Yes (%)	342 (67.5)
	No (%)	164 (32.5)
Family deaths due to COVID-19	Yes (%)	54 (10.7)
	No (%)	452 (89.3)
Days of hospitalization (1–118)	Mean ± SD	4.52 ± 12.20
Days of home isolation (0–120)	Mean ± SD	32.22 ± 18.53

Note. $N = 506$.

2.2.2. Impact of event scale-revised (IES-R)

The IES-R (Creamer et al., 2003) consists of 22 items that evaluate the degree of subjective distress following traumatic events (Sundin and Horowitz, 2002, 2003). The questionnaire assesses the total post-traumatic stress score and scores on three subscales corresponding to the three main clusters of PTSD (i.e., intrusion, avoidance, and hyperarousal). Each item is rated on a five-point scale ranging from 0 (Not at all) to 4 (Extremely). An adaptation of the Italian version of the questionnaire (Craparo et al., 2013) was used for this study, and each item was adapted to the specific COVID-19 disease event (e.g., "Any reminders brought back feelings about the COVID-19 disease".

2.2.3. Toronto alexithymia scale-20 (TAS-20)

The TAS-20 is a 20-items self-report questionnaire used to assess alexithymia and its main dimensions (Bagby et al., 1994). Each item (e.g., "I am often confused about what emotion I am feeling," "It is difficult for me to find the right words for my feelings") was rated on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree), with five items negatively keyed. In addition to the total score indicative of the general level of alexithymia, the TAS-20 also calculates scores for the three main dimensions of alexithymia: difficulty in identifying feelings (DIF); difficulty in describing feelings (DDF); and externally oriented thinking (EOT). The original version of the TAS-20 has been validated in several countries, including Italy (Bressi et al., 1996; Caretti and La Barbera, 2005).

2.2.4. Dissociative experience scale-ii (DES-II)

The DES-II (Carlson and Putnam, 1993) is a 28-item self-report measure of dissociative experiences. Each item is answered by indicating a percentage ranging from 0 to 100%, at 10% intervals, corresponding to the percentage of time the subject lives each experience (e.g., "Some people have the experience of driving or riding in a car or bus or subway and suddenly realizing that they don't remember what has happened during all or part of the trip. Circle the number to show what percentage of the time this happens to you"). Higher scores correspond to higher levels of dissociative symptoms. The Italian version of the questionnaire has been widely used and validated with clinical and non-clinical populations (Craparo et al., 2014a, 2013, 2014b).

2.2.5. Hospital anxiety and depression scale (HADS)

The HADS consists of 14 items and assesses the presence of anxiety and depressive symptoms in people suffering from various physical pathologies. It includes seven items assessing cognitive and emotional aspects of depression and seven items focusing on anxiety symptoms. Each item (e.g., "I get a sort of frightened feeling as if something awful is about to happen," "I have lost interest in my appearance") is scored on a four-point Likert scale ranging from 0 (not at all) to 3 (most of the time). It is possible to calculate the scores for the anxiety subscale (HADS-A) and the depression subscale (HADS-D). The Italian translation of the questionnaire was already used in clinical samples with suitable psychometric properties (Costantini et al., 1999; Iani et al., 2014).

2.3. Statistical analyses

We performed a sensitivity power analysis to determine the strength of the effects that can be reliably detected from the regression models. Confirmatory Factor Analysis (CFA) was conducted to test each scale's measurement model. Parameter estimation was carried out by the

Diagonal Weighted Least Squares (DWLS) due to the ordinal nature of the items (Mîndrilă, 2010). Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), Root Mean Square Error of Approximation (RMSEA), and Root Mean Square Residual (RMSR) were used to assess the goodness of fit. More specifically, fit was considered adequate if the CFI and TLI values were > 0.90, and better if they were > 0.95 (van de Schoot et al., 2012); RMSEA values smaller than 0.05 indicated good fit, values between 0.05 and 0.08 indicated acceptable Model fit and values greater than 0.10 suggested poor model fit (Hu and Bentler, 1999). Finally, RMSR values smaller than 0.08 indicated a good fit (Hu and Bentler, 1999). For each scale, items internal consistency was evaluated using Cronbach's alpha. Internal consistency is considered acceptable when α > 0.70 (DeVellis, 2017). The Alpha if Dropped (AiD) and the Corrected Item-Total Correlation (CITC) were calculated for each item within the scale. A value greater than 0.30 was considered acceptable (Wang et al., 2007).

Mean (M) ± standard deviation (SD) were used for continuous variables, while categorical variables were expressed as frequencies and percentages. The score for each scale (total and by factors) was calculated as the average of the items. All composite scores were standardized to z-scores to compare regression coefficients.

Correlations between continuous variables were evaluated using Pearson's correlation coefficient. Finally, multiple hierarchical regressions were run to identify which variables predict post-traumatic stress symptoms in individuals who recovered from COVID-19. More specifically, scores from the three subscales of the IES-R were the dependent variables of the regression models. The predictors entered into the Model were gender, age, type of therapy, days of hospitalization, and scores on the scales PID-5-BF, TAS-20, DES-II, and HADS scales.

All the analyses were performed with R for macOS, version 4.0.5. (R Development Core Team, 2021).

3. Results

3.1. Sensitivity power analysis

A sensitivity power analysis was performed to determine the minimum effect size detectable for each predictor. With a sample size of 506 individuals, a power of 0.80, 13 predictors (i.e., the maximum number of predictors included in regression), and α = 0.05, the present sample size was adequate to detect a minimum effect of f2 = 0.012, which is considered a small effect (Cohen, 1988). The analysis was performed with G*Power 3.1 (Faul et al., 2007).

3.2. Psychometric characteristics of the scales

The CFA results suggested that all scales used in this study were valid and reliable measures of their respective constructs. The goodness of fit indices were satisfactory for all scales, as shown in Table 2.

Factor loadings did not reveal problematic items in the IES-R, DES-II, PID-5-BF, and HADS scales, as all items exceeded the cut-off of 0.40 (Pituch and Stevens, 2016). In contrast, the analysis of factor loadings revealed some problematic items in the TAS-20 scale (item 4 = 0.36, item 5 = 0.14, item 10 = 0.17, items 18 and 19 = 0.05).

Cronbach's alpha was used to assess the internal consistency of the scales. IES-R items (avoidance α = 0.86, intrusion α = 0.91, and hyperarousal α = 0.74), PID-5-BF items (Negative affect α = 0.75, Detachment α = 0.75, Antagonism α = 0.72, Disinhibition α = 0.74, Psychoticism α = 0.78), and HADS items (Anxiety α = 0.87 and Depression α = 0.83) showed good internal consistency. DES-II and TAS-20 also showed good reliability (both α = 0.95). However, some items of the TAS-20 showed low discrimination. Similar to the CFA results, items 5, 10, 18, and 19 showed CITC values were below the acceptability cut-off point (> 0.30). These items are all reversed items, which could explain their low validity and reliability. Based on these considerations, the items were removed.

Table 2
Psychometric characteristics of the scales.

Scale	CFI (> 0.90)	TLI (> 0.90)	RMSEA [90% CI] (< 0.10)	SRMR (< 0.10)
IES-R	.995	.995	.034 [.028–0.041]	.05
DES-II	.998	.998	.013 [.00–0.021]	.06
TAS-20	.955	.949	.067 [.061–0.073]	.08
PID-5-BF	.987	.986	.032 [.026–0.039]	.05
HADS	.995	.994	030 [.017–0.041]	.05

Note. N = 506, IES-R = Impact of Event Scale-Revised, DES-II = Dissociative Experience Scale-II, TAS-20 = Toronto Alexithymia Scale-20, PID-5-BF = Personality Inventory for DSM-5 Brief Form, HADS = Hospital Anxiety and Depression Scale.

3.3. Correlations between scale scores

Table 3 reports descriptive statistics and correlations for scales scores. Statistically significant, strong positive correlations were found between all the study variables.

The IES-R total score was positively correlated with all the personality traits measured by the PID-5-BF and, in particular, with Negative Affectivity (r = 0.52) and Psychoticism (r = 0.46). Specifically, the avoidance, intrusion, and hyperarousal subscales were significantly correlated with negative affectivity and psychoticism (Table 3).

Furthermore, significant and positive correlations were obtained between the IES-R subscales scores and DES-II and HADS scores, as reported in Table 2.

Finally, IES-R total score was positively correlated with the TAS-20 total score. The other correlations between the study variables are shown in Table 3.

3.4. Hierarchical multiple regression analyses

A series of multiple hierarchical regressions were run to identify which variables predict major symptoms of post-traumatic stress (i.e., intrusion, avoidance, and hyperarousal) in individuals who recovered from COVID-19.

The first hierarchical multiple regression was run considering Avoidance scores as the dependent variable and sex, age, type of therapy, days of hospitalization, PID-5-BF, TAS-20, DES-II, and HADS scores as independent variables (Table 4).

The explanatory power of Model 1 was 32.9%, indicating that avoidance is higher among subjects with high levels of negative affectivity (β = 0.14) and alexithymia (β = 0.45). The explanatory power of Model 2 increased to 40.4% (p < .001) over the output of Model 1 by adding the variables related to the experience of hospitalization. More specifically, this Model showed that increased levels of alexithymia (β = 0.32), dissociation (β = 0.13), and anxiety (β = 0.25) lead to a higher tendency to avoidance. However, in Model 2, there was no longer a significant effect of Negative Affectivity (β = 0.02).

Regarding the hierarchical multiple regression to predict intrusion (Table 5), the explanatory power of Model 1 was 32.0%; more specifically, the intrusion was significantly predicted by negative affectivity (β = 0.28), antagonism (β = −0.12), psychoticism (β = 0.13) and alexithymia (β = 0.34). The explanatory power of Model 2 increased to 47.4% over the output of Model 1. In this Model, there was no longer a significant effect of antagonism (β = −0.05), and psychoticism (β = 0.07), while negative affectivity (β = 0.09), alexithymia (β = 0.17), anxiety (β = 0.37), depression (β = 0.13), and hospitalization for COVID-19 treatment (β = 0.36) significantly predicted intrusion.

Finally, regarding hyperarousal (Table 6), the explanatory power of Model 1 was 35.4%, and hyperarousal was significantly predicted by negative affectivity (β = 0.32) and alexithymia (β = 0.35). On the other

Table 3
Descriptive statistics and correlations for study variables.

Variable	M	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Age	47.21	10.91	-													
2. PID-5-BF NA	1.56	0.68	.02	-												
3. PID-5-BF AN	0.56	0.50	.02	.39**	-											
4. PID-5-BF DE	1.00	0.66	.05	.53**	.46**	-										
5. PID-5-BF DI	0.81	0.63	.06	.36**	.43**	.33**	-									
6. PID-5-BF PS	0.81	0.63	0	.57**	.54**	.59**	.48**	-								
7. DES-II	17.38	14.65	-0.18**	.35**	.31**	.36**	.33**	.59**	-							
8. IES-R Avoidance	1.86	0.97	0	.43**	.24**	.37**	.27**	.42**	.44**	-						
9. IES-R Intrusion	2.28	1.04	.04	.49**	.17**	.33**	.22**	.43**	.39**	.78**	-					
10. IES-R Hyperarousal	2.46	1.03	-0.01	.53**	.21**	.38**	.24**	.43**	.46**	.76**	.83**	-				
11. IES-R Total	2.19	0.97	.01	.52**	.22**	.39**	.26**	.46**	.47**	.92**	.94**	.93**	-			
12. TAS-20 Total	2.93	1.07	.02	.52**	.35**	.58**	.35**	.59**	.50**	.55**	.49**	.51**	.56**	-		
13. HADS-Anxiety	2.50	0.67	-0.02	.56**	.17**	.35**	.18**	.38**	.42**	.53**	.63**	.68**	.66**	.48**	–	
14. HADS-Depression	2.14	0.62	.02	.45**	.14**	.50**	.12*	.41**	.42**	.44**	.52**	.55**	.54**	.44**	.62**	–

Note. $N = 506$, PID-5-BF = Personality Inventory for DSM-5 Brief Form, NA = Negative Affectivity, DE = Detachment, AN = Antagonism, DI = Disinhibition, PS = Psychoticism, DES-II = Dissociative Experience Scale-II, IES-*R* = Impact of Event Scale-Revised, TAS-20 = Toronto Alexithymia Scale-20, DIF = difficulty in identifying feelings, DDF = difficulty in describing feelings, EOT = externally orientated thinking, HADS = Hospital Anxiety and Depression Scale $^{*}p < .05$; $^{**}p < .01$.

Table 4
Predictors of IES-R Avoidance in hierarchical regression models ($N = 506$).

	Model 1			Model 2		
	β	95% CI	p	β	95% CI	p
(Intercept)	-0.06	-0.26–0.13	0.334	-0.06	-0.26–0.14	0.402
Gender [female]	0.07	-0.14–0.28	0.496	0.02	-0.18–0.23	0.827
Age	0.01	-0.07–0.08	0.858	0.02	-0.06–0.09	0.670
PID-5-BF NA	0.14	0.04–0.23	0.004	0.02	-0.08–0.12	0.665
PID-5-BF DE	-0.01	-0.11–0.09	0.859	-0.01	-0.11–0.09	0.822
PID-5-BF AN	-0.01	-0.10–0.08	0.806	0.02	-0.06–0.11	0.575
PID-5-BF DI	0.04	-0.04–0.13	0.342	0.06	-0.02–0.15	0.132
PID-5-BF PS	0.04	-0.07–0.15	0.451	-0.03	-0.15–0.08	0.572
TAS-20 total	0.45	0.35–0.55	< 0.001	0.32	0.22–0.42	< 0.001
Days of hospitalization				-0.04	-0.14–0.06	0.483
DES-II total				0.13	0.03–0.22	0.008
HADS-Anxiety				0.25	0.15–0.35	<0.001
HADS-Depression				0.06	-0.04–0.16	0.221
Hospitalization [yes]				0.20	-0.05–0.45	0.109
R^2 / Adjusted R^2	0.329 / 0.318			0.404 / 0.389		

Note: PID-5-BF = Personality Inventory for DSM-5 Brief Form, NA = Negative Affectivity, DE = Detachment, AN = Antagonism, DI = Disinhibition, PS = Psychoticism, TAS-20 = Toronto Alexithymia Scale-20, DES-II = Dissociative Experience Scale-II, HADS = Hospital Anxiety and Depression Scale.

Table 5
Predictors of IES-R Intrusion in hierarchical regression models ($N = 506$).

	Model 1			Model 2		
	β	95% CI	p	β	95% CI	p
(Intercept)	-0.11	-0.31–0.08	0.145	-0.16	-0.34–0.03	0.069
Gender [female]	0.13	-0.08–0.34	0.228	0.09	-0.10–0.28	0.334
Age	0.04	-0.03–0.11	0.288	0.02	-0.05–0.09	0.557
PID-5-BF NA	0.28	0.19–0.38	< 0.001	0.09	0.00–0.19	0.044
PID-5-BF DE	-0.07	-0.17–0.03	0.178	-0.09	-0.18–0.01	0.068
PID-5-BF AN	-0.12	-0.21–0.02	0.013	-0.05	-0.13–0.03	0.203
PID-5-BF DI	-0.00	-0.09–0.08	0.975	0.04	-0.03–0.12	0.264
PID-5-BF PS	0.13	0.02–0.25	0.017	0.07	-0.04–0.18	0.193
TAS-20 total	0.34	0.24–0.44	< 0.001	0.17	0.07–0.26	< 0.001
Days of hospitalization				-0.03	-0.13–0.06	0.497
DES-II total				0.07	-0.02–0.15	0.142
HADS-A				0.37	0.28–0.47	< 0.001
HADS-D				0.13	0.04–0.22	0.006
Hospitalization [yes]				0.36	0.12–0.59	0.003
R^2 / Adjusted R^2	0.320 / 0.309			0.474 / 0.460		

Note: PID-5-BF = Personality Inventory for DSM-5 Brief Form, NA = Negative Affectivity, DE = Detachment, AN = Antagonism, DI = Disinhibition, PS = Psychoticism, TAS-20 = Toronto Alexithymia Scale-20, DES-II = Dissociative Experience Scale-II, HADS = Hospital Anxiety and Depression Scale, *A* = Anxiety, *D* = Depression.

hand, the explanatory power of Model 2 significantly increased to 53.0% ($p < .001$) over the output of Model 1, suggesting that increased levels of dissociation (β = 0.13), anxiety (β = 0.41), and depression (β = 0.12), as well as hospitalization for COVID-19 treatment (β = 0.26), lead to higher hyperarousal.

4. Discussion

This study aimed to investigate the relationship between post-traumatic symptoms and personality traits, alexithymia, dissociation, anxiety, and depression in subjects who have recovered from COVID-19

Table 6
Predictors of IES-R Hyperarousal in hierarchical regression models ($N = 506$).

	Model 1			Model 2		
	β	CI	p	β	CI	p
(Intercept)	-0.17	-0.36–0.02	0.035	-0.15	-0.33–0.03	0.061
Gender [female]	0.20	-0.01–0.40	0.060	0.11	-0.07–0.29	0.226
Age	0.00	-0.07–0.07	0.944	0.02	-0.05–0.08	0.628
PID-5-BF NA	0.32	0.23–0.41	<0.001	0.13	0.04–0.21	0.004
PID-5-BF DE	-0.02	-0.12–0.07	0.619	-0.04	-0.13–0.05	0.348
PID-5-BF AN	-0.06	-0.15–0.03	0.182	-0.00	-0.08–0.08	0.961
PID-5-BF DI	-0.01	-0.09–0.08	0.893	0.03	-0.04–0.11	0.382
PID-5-BF PS	0.06	-0.05–0.16	0.309	-0.02	-0.13–0.08	0.632
TAS-20 total	0.35	0.25–0.45	< 0.001	0.17	0.08–0.26	< 0.001
Days of hospitalization				-0.08	-0.17–0.01	0.075
DES-II total				0.13	0.04–0.21	0.003
HADS-A				0.40	0.31–0.49	< 0.001
HADS-D				0.11	0.03–0.20	0.010
Hospitalization [yes]				0.26	0.04–0.48	0.021
R^2 / Adjusted R^2	0.354 / 0.344			0.530 / 0.517		

Note: PID-5-BF = Personality Inventory for DSM-5 Brief Form, NA = Negative Affectivity, DE = Detachment, AN = Antagonism, DI = Disinhibition, PS = Psychoticism, TAS-20 = Toronto Alexithymia Scale-20, DES-II = Dissociative Experience Scale-II, HADS = Hospital Anxiety and Depression Scale.

and have undergone different treatment options to treat the disease. In particular, we investigated whether these variables, together with having had a more severe form of COVID-19 requiring hospitalization, may be predictors of post-traumatic stress symptoms.

The experience of COVID-19 is a traumatic event for individuals who recover from the disease. The mean scores of the IES-R scale in our sample are significantly high, confirming that COVID-19 can be a traumatic event and lead to the onset of PTSD symptoms, as already documented in the literature (Bo et al., 2021; La Rosa et al., 2021).

In line with the literature (La Rosa et al., 2021; Velotti et al., 2021) and the hypotheses, our results also confirmed the strict relationship between PTSD symptoms, alexithymia, and dissociation. Indeed, regression models showed that high levels of alexithymia and dissociation statistically significantly predict the three main clusters of PTSD symptoms (avoidance, intrusion, and hyperarousal) in subjects who have recovered from COVID-19. Specifically, higher levels of alexithymia and dissociation are associated with increased post-traumatic symptoms.

Furthermore, the results of this study showed a significant relationship between PTSD and pathological personality traits. More specifically, negative affectivity and psychoticism were the personality traits that significantly predicted PTSD symptoms in our sample subjects. Negative affectivity is characterized by the tendency to experience negative emotions, such as anger or anxiety and emotion dysregulation; psychoticism refers to the tendency to have odd or unusual behavior experiences, misperceive social cues, and behave eccentrically (American Psychiatric Association, 2013b; Hopwood et al., 2013). In our study, these personality patterns increase the risk of developing post-traumatic symptoms following the COVID-19 experience. This data is consistent with findings in the literature, according to which there is a significant relationship between pathological personality and PTSD in subjects exposed to traumatic events (Velotti et al., 2021). In this regard, a study by Reis et al. (2016) underscored that individuals who experienced disaster events showed more pathological personality traits when compared to those who did not experience these events. Similarly, a systematic review by Jakšić et al. (2012) confirms the role of personality traits in developing PTSD symptoms. According to that study, there is a significant association between PTSD and negative emotionality, neuroticism, trait hostility/anger, and trait anxiety.

The presence of anxiety and depression is also significantly associated with the development of PTSD symptoms in the recovered subjects of our sample. This result is also consistent with the literature, according to which patients recovering from COVID-19 have higher levels of anxiety and depression, which are associated with a higher risk of PTSD (Saevarsdottir et al., 2021).

As hypothesized, subjects hospitalized for COVID-19 are more likely to develop PTSD symptoms than those never admitted to the hospital. Interestingly, hospitalization is significantly associated with the clusters of intrusions and hyperarousal, suggesting that the experience of hospitalization tends mainly to be re-experienced, keeping the subject in a state of hypervigilance with insomnia, irritability, and decreased concentration. In addition, according to the literature, high rates of post-traumatic symptoms have been reported in clinically stable people discharged from hospital after recovering from COVID-19 (Bo et al., 2021; Saevarsdottir et al., 2021). This finding underlines the importance of focusing on the mental health outcomes of this specific group of patients.

Finally, according to the literature data, the results confirm that alexithymia and dissociation play an important role in the relationship between PTSD and pathological personality traits (Brand and Lanius, 2014; Briere, 2006). Indeed, both negative affectivity and psychoticism were significantly associated with levels of alexithymia and dissociation in our sample. Several authors have previously investigated the relationship between dissociation, emotion dysregulation, personality disorders, and PTSD. For example, Van DiJke et al. (2018) highlighted that trauma exposure leads to the development of post-traumatic symptoms and personality disorders. Furthermore, emotion dysregulation and dissociative symptoms may further increase this risk (Briere, 2006).

4.1. *Strengths and limitations*

Our study has important strengths but also objective limitations that must be considered. To the best of our knowledge, this is one of the first studies carried out in Italy on the psychological consequences of COVID-19 in a sample of subjects who have recovered from the disease. More specifically, the study focused on risk factors related to personality characteristics and the type of treatment for COVID-19 in developing post-traumatic stress symptoms. Other important strengths are the considerable sample size and the use of validated questionnaires widely used in the literature, which also demonstrated excellent psychometric properties in this study.

Regarding the study's limitations, we used an internet-based survey with self-reported measures due to the social distancing rules to contain the contagion. Although the questionnaires showed good reliability and internal consistency, self-reported measures are subject to several risks, such as the phenomenon of social desirability and, therefore, the falsification of answers. Furthermore, the study's cross-sectional nature made it impossible to assess the exact causal relationship between the study variables. Finally, the way the sample was recruited resulted in an imbalance in the sample composition. For this reason, it was not possible to compare subgroups of hospitalized patients to avoid bias due to

unbalanced group sizes. In this regard, future studies will focus on the specific impact of different hospitalization regimes on the development of post-traumatic symptoms in patients who have recovered from COVID-19. Furthermore, it would be beneficial to conduct studies that investigate the impact of the presence of symptoms even after recovery from COVID-19 on mental health outcomes and identify post-COVID-19 signs most associated with distress and adverse psychological outcomes.

5. Conclusion

This study confirms the need to address the potential long-term consequences of COVID-19 for the mental health of people who have or had this disease. It has been widely emphasized that an adequate assessment of the psychiatric symptoms of patients with COVID-19 is important for better prognostic outcomes. The importance of this topic is further stressed by the so-called "long COVID-19," which refers to people who recovered from COVID-19 but still present lasting physical and neurological symptoms.

In this scenario, our findings are valuable in identifying the main risk factors to consider when improving psychological and psychotherapeutic support for these individuals. As confirmed by the results of this study, the pandemic has emphasized the psychological importance of the body and especially of the traumatic emotions that affect it. Therefore, it is essential to work on bodily experiences from a psychotherapeutic point of view. It has been widely demonstrated that trauma is stored in somatic memory and expressed as changes in the biological response to stress.

In this sense, the COVID-19 pandemic poses the need to implement mental health services to address the long-term mental health needs of people who have experienced the disease.

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CRediT authorship contribution statement

Giuseppe Craparo: Conceptualization, Methodology, Writing – original draft, Supervision. **Valentina Lucia La Rosa:** Investigation, Data curation, Writing – original draft. **Graziella Marino:** Visualization, Investigation. **Michela Vezzoli:** Data curation, Writing – review & editing. **Gabriella Serena Cinà:** Writing – review & editing. **Morena Colombi:** Investigation, Writing – review & editing. **Giuseppe Arcoleo:** Investigation, Writing – review & editing. **Maria Severino:** Investigation, Writing – review & editing. **Giulia Costanzo:** Software, Validation. **Ernesto Mangiapane:** Conceptualization, Supervision.

Declaration of Competing Interest

The authors have no conflict of interest.

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