A nine-month study on the course of COVID-19 related perceived post-traumatic stress disorder among Italian community-dwelling adults

Antonella Somma [a], Robert F. Krueger [b], Kristian E. Markon [c], Giulia Gialdi [a], Miriana Colanino [a], Danila Ferlito [a], Chiara Liotta [a], Andrea Fossati [a,*]

[a] *Vita-Salute San Raffaele University, Milan, Italy*
[b] *University of Minnesota, Minneapolis, MN, USA*
[c] *University of Iowa, Iowa City, IA, USA*

A R T I C L E   I N F O

A B S T R A C T

The present study aimed to evaluate base rate estimates, course of, and psychopathology and personality risk factors for COVID-19-related post-traumatic stress disorder (PTSD) in community-dwelling adults during the pandemic. 203 participants from a sample of 811 Italian community-dwelling adults agreed to participate in a nine-month, three-wave (Wave 1: March 2020; Wave 2: June 2020; Wave 3: December 2020) longitudinal study. Participants in the longitudinal study did not differ from the cross-sectional original sample on age, gender, civil status, educational level, occupation, and Italian area of residence. At each wave, participants were administered the PTSD scale of the International Trauma Questionnaire (ITQ), DSM-5 measures of acute stress, dissociation, depression and anxiety, as well as a maladaptive personality domain measure at Wave 1. Participants were instructed to answer to the ITQ items based only on COVID-19 pandemic and related containment measures. The point prevalence estimates of COVID-19 related PTSD at each wave ranged from 11% to 13%; however, up to roughly 23% of our participants experienced clinically relevant PTSD features during nine months of the COVID-19 pandemic in Italy. Multiple logistic regression results showed that experiencing internalizing symptoms (i.e., mostly acute stress) and selected personality features (i.e., Negative Affectivity and Psychoticism) at Wave 1 represent risk factors for PTSD symptoms at later waves. These findings extend previous knowledge on COVID-19 related PTSD and support the need for preventive and treatment interventions for PTSD during the COVID-19 pandemic.

1. Introduction

Social distancing and stay-at-home measures related to the spread of the novel coronavirus SARS-CoV-2 and its associated disease (designated COVID-19) are related to the wider social impact of the COVID-19 pandemic (Brooks et al., 2020; Lewnard and Lo, 2020). Notably, physical distancing and quarantine measures instituted to mitigate spread of the pandemic were reported to be associated also with an increase in psychological distress in the general population (e.g., Xiong et al., 2020), persons with pre-existing mental disorders (e.g., Rogers et al., 2020), as well as in healthcare workers (e.g., de Pablo et al., 2020). Moreover, social distancing and stay-at-home orders may be experienced as a traumatic stressor (e.g., CDC, 2020) by both infected and non-infected populations (e.g., Rogers et al., 2020). Not surprisingly, recent studies showed that post-traumatic stress disorder (PTSD)

symptoms were commonly observed both in health care workers (e.g., de Pablo et al., 2020; Serrano-Ripoll et al., 2020), and patients with COVID-19 in intensive care (see for a review, Rogers et al., 2020). Moreover, a recent systematic review (e.g., Xiong et al., 2020) showed that there is a higher prevalence of psychiatric symptoms than before the pandemic even among community participants, with PTSD symptoms rates showing a high variability, with estimates ranging from 7-8% (Casagrande et al., 2020; Zhang and Ma, 2020; Liu et al., 2020) to 54% (Wang et al., 2020).

Individual differences are important to understanding reactions to the COVID-19 pandemic and social distancing measures. Extraversion and openness to experience are known to be related to perceiving events as challenges rather than threats, as well as to positive appraisals of coping resources. High neuroticism in contrast predicts especially high stress exposure (e.g., Carver and Connor-Smith, 2010), even during the

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COVID-19 pandemic (e.g., Nikčević et al., 2021). Notably, Somma and colleagues' (2021) study aimed at evaluating the trajectories of change in depression, anxiety, acute stress and dissociation dimensions until June 2020 (i.e., Wave 2 of the present study); however, no data on PTSD were considered in that study and the current results represent a completely novel use of the data.

Thus, although it is known that the COVID-19 pandemic is associated with highly significant levels of psychological distress (Xiong et al., 2020), the long-term psychological effects of the COVID-19 pandemic have not been tracked (Ran et al., 2020), particularly with respect to PTSD symptoms in longitudinal studies among community-dwelling participants. Against this background, the present study aimed at evaluating the prevalence of PTSD symptoms in a sample of community-dwelling Italian adults who were administered an International Classification of Disease-11th Edition (ICD-11) measure of PTSD five days after the quarantine had been enforced in Italy (March 2020; i. e., Wave 1), at the end of the quarantine in Italy (June 2020; i.e., Wave 2), as well as six months later (December 2020; i.e., Wave 3). In the present study, we also aimed at assessing the role of acute stress, dissociation, anxiety, and depression symptoms in predicting the presence of COVID-19-related PTSD at the beginning of the lockdown, at the end of the lockdown, as well as in December 2020. Finally, dysfunctional personality domains were assessed at the beginning of the lockdown in Italy in order to evaluate their role in predicting the presence of PTSD at Wave 1, Wave 2, and Wave 3 of our longitudinal study because they were shown to be predictive of traumatic reactions in previous studies (see Xiong et al., 2020). In the present study, we relied on a measure of dysfunctional personality dimensions that could assess both *Diagnostic and Statistical Manual of Mental Disorders* (*DSM-5*) Alternative Model of Personality Disorders (AMPD; APA, 2013a) and ICD-11 personality domains.

2. Materials and methods

2.1. Participants

Data were part of an online longitudinal study of emotional response to COVID-19 quarantine measures in Italy (see also Somma et al., 2021). Specifically, the online study started on March 14, 2020, i.e., five days after the quarantine had been enforced in Italy; participants were asked to report how they were feeling every week until June 2020, and then in December 2020. The data reported in the present study were drawn from the baseline assessment (March 2020; i.e., Wave 1), the assessment that took place at the end of the quarantine in Italy (June 2020; i.e., Wave 2), and from the six-months follow-up assessment (December 2020; Wave 3).

The original sample included 811 Italian community-dwelling adult participants, with a mean age of 33.94 years ($SD = 13.91$ years; age range: 18 years–78 years). Two hundred and six (25.4%) participants were male, and 601 (74.1%) participants were female, whereas 4 (0.5%) participants preferred not to disclose their gender. Originally, 822 participants opened the link for taking part into the research; however, 11 participants did not provide any data (response rate = 98.7%). Of the original sample ($N = 811$), 203 (25.0%) participants were able to provide complete data on all occasions; unfortunately, we were unable to obtain information on the drop out reasons. Participants who completed the study did not differ significantly from participants who did not complete the study on age, $t(805) = 1.01$, $p > .30$, $d = 0.07$, gender, $\chi^2(2) = 2.65$, $p > .25$, Cramer $V = 0.06$, civil status, $\chi^2(3) = 5.72$, $p > .10$, Cramer $V = 0.08$, education level, $\chi^2(4) = 6.38$, $p > .15$, Cramer $V = 0.08$, occupation, $\chi^2(9) = 6.38$, $p > .15$, Cramer $V = 0.09$, and Italy's area (i.e., Northern, Central, and Southern Italy, and Italian Islands) where they were living, $\chi^2(3) = 2.11$, $p > .50$, Cramer $V = 0.05$.

Thus, the final sample was composed of 203 Italian community-dwelling adult participants, with a mean age of 34.81 years ($SD = 14.62$ years; age range: 18 years–77 years). Forty-five (22.2%)

participants were male, and 155 (76.4%) participants were female; three (1.5%) participants refused to disclose their gender. One hundred and ten (54.2%) participants were unmarried, 74 (36.5%) were married, 14 (6.9%) participants were divorced, and 5 (2.5%) participants were widowed/-ers. Twelve (5.9%) participants had a junior high school degree, 70 (34.5%) participants had a high school degree, 99 (48.8%) participants had a university degree, and 22 (10.8%) participants had a doctoral degree. Sixty-eight (33.5%) participants were students, 63 (31.0%) participants were white collar workers, 24 (11.8%) were freelance professionals, 11 (5.4%) participants were blue collar workers, 4 (2.0%) participants were housekeepers, 3 (1.5%) participants were managers, and 2 (1.0%) participants were retailers; finally, 7 (3.4%) participants were unemployed, and 11 (5.4%) participants were retired, whereas 10 (4.9%) participants declined to report their occupation. In our sample, 134 (66.0%) participants were living in Northern Italy, 28 (13.8%) participants lived in Central Italy, 30 (14.8%) participants were living in Southern Italy, and 10 (4.9%) participants were living on Italian Islands (i.e., Sardinia and Sicily); one (0.5%) participant refused to report the region where he/she was living.

2.2. Measures

International Trauma Questionnaire Post Traumatic Stress Disorder Scale (ITQ PTSD; Cloitre et al., 2016*)*. The ITQ is a Likert-type self-report questionnaire that was designed to assess the ICD-11 PTSD and complex configurations of PTSD symptoms, as well as the related impairment in the level of functioning. The ICD-11 PTSD is defined by three clusters each containing two symptoms (Maercker et al., 2013): re-experiencing of the trauma in the present (Re); avoidance of traumatic reminders (Av); and a persistent sense of threat that is manifested by increased arousal and hypervigilance (Th). In the present study, participants were administered only ITQ PTSD items, and they were asked to answer each item in relation to COVID-19 experience. The ITQ was provided with adequate reliability and validity across different languages and contexts (e.g., Murphy et al., 2020; Sele et al., 2020); notably, previous reports documented the reliability and validity of the Italian translation of the ITQ (e.g., Somma et al., 2019). In the present study, the one factor model of ITQ PTSD showed to be provided with longitudinal scalar invariance (see Supplementary Material Table S1).

*DSM-5 Level 2 Depression (*APA, 2013b*)*. The *DSM-5* Level 2 Depression measure is the 8-item PROMIS Depression Short Form that assesses the domain of depression in individuals age 18 and older. Items are rated on a 5-point scale with higher scores indicating greater severity of depression (APA, 2013b). The psychometric properties and scalar longitudinal invariance of the Italian translation of the *DSM-5* Level 2 Anxiety measure have been published (Somma et al., 2020).

*DSM-5 Level 2 Anxiety (*APA, 2013c*)*. The *DSM-5* Level 2 Anxiety measure is the 7-item PROMIS Anxiety Short Form; it was designed to assess anxiety in subjects of age 18 and older. Items are rated on a 5-point scale. The raw scores on the 7 items should be summed to obtain a total raw score; higher scores indicating greater severity of depression (APA, 2013c). The psychometric properties and scalar longitudinal invariance of the Italian *DSM-5* Level 2 Anxiety measure have been published (Somma et al., 2020).

*DSM-5 Severity of Acute Stress Symptoms (*APA, 2013d*)*. The *DSM-5* Severity of Acute Stress Symptoms (National Stressful Events Survey Acute Stress Disorder Short Scale) is a 7-item measure that assesses the severity symptoms of acute stress disorder in individuals age 18 and older. Each item is rated on a 5-point scale; subjects are asked to rate each item with respect to the last 7 days. The items are summed to obtain a total score ranging from 0 to 28, with higher scores indicating greater severity of acute stress disorder symptoms. The psychometric properties and scalar longitudinal invariance of the Italian *DSM-5* Severity of Acute Stress Symptoms measure have been published (Somma et al., 2020).

*DSM-5 Severity of Dissociative Symptoms (*APA, 2013e*)*. The *DSM-5* Severity of Dissociative Symptoms (Brief Dissociative Experiences

Scale-Modified) assesses the severity of dissociative experiences in individuals age 18 and older. It is a self-report 8-item measure; each item is rated on a 5-point scale (from *0 = Not at all* to *4=Extremely*); items are summed to obtain a total score, ranging from 0 to 32, with higher scores indicating greater severity of dissociative experiences. The psychometric properties and longitudinal invariance of the Italian translation of the *DSM-5* Severity of Dissociative Symptoms measure have been published (Somma et al., 2020).

Personality Inventory for DSM-5-Brief Form + Modified (PID-5-36; Bach et al., 2020*).* The PID-5-36 is a 36-item self-report instrument developed by Bach et al. (2020) based on the original PID-5 (Krueger et al., 2012), and on the instrument developed by Kerber et al. (2020) to assess the combined *DSM-5* and ICD-11 domains (i.e., negative affectivity, detachment, antagonism, disinhibition, anankastia, and psychoticism). The PID-5-36 psychometric properties have been tested in an international collaborative study, which included the Italian translation of the PID-5-36 (Bach et al., 2020).

2.3. Measure translation procedures

In the present study, all measures were administered to participants in their Italian translations. In the translation process, the authors closely followed Denissen et al.'s (2008) indications. The translation procedures are detailed elsewhere (Bach et al., 2020; Somma et al., 2021).

2.4. Procedure

Participants completed the study online using Google Forms; participants volunteered to take part in the study receiving no economic incentive or academic credit for their participation. To be included in the sample, participants had to document that they were of adult age (i. e., 18 years of age or older), and to agree to online written informed consent in which the study was extensively described. Institutional Review Board approval was obtained. A detailed description of study procedures is provided in Somma et al. (2021).

2.5. Data analysis

Cronbach's alpha was used as an internal consistency reliability index. Pearson *r* coefficient was used to assess the relationships between continuous variables. Cohen's κ statistic was computed to evaluate the temporal consistency of PTSD diagnoses. The relative risk (*RR*) statistic was used as an estimator of the excess risk among participants who met PTSD criteria in a wave as compared to participants who did not meet PTSD criteria in the preceeding wave (Horwath et al., 1992; Tsuang et al., 1995). Cochran's *Q* test was used to test the hypothesis that the proportions of participant's meeting PTSD diagnosis did not significantly differ across the three waves. The area under the curve (AUC) values based on receiver operating characteristic (ROC) analyses were used to evaluate the accuracy of internalizing symptoms and personality domains as indicators of COVID-19 related PTSD diagnosis versus non-diagnosis. Consistent with cohort study standards (Vandenbroucke et al., 2007), we carried out multiple logistic regression analysis to assess the role of acute stress, dissociation, anxiety, and depression scale scores assessed at previous waves as predictors of COVID-19 related PTSD diagnosis at later waves. Because we were interested in assessing the consistency of our findings across all waves of our study, we also ran multiple logistic regression analysis to assess the role of acute stress, dissociation, anxiety, and depression scale scores as predictors of COVID-19 related PTSD diagnosis withing each wave. Similarly, we carried out multiple logistic regression analyses to assess the role of dysfunctional personality domains as predictors of PTSD diagnosis at Wave 1, Wave 2, and Wave 3. Condition index and variance inflation factors (VIF) were used as multicollinearity indices.

3. Results

The base rate estimates and diagnostic mobility statistics for the COVID-19 related PTSD diagnoses based on the ITQ self-reports that were observed at Wave 1 (March 2020), Wave 2 (June 2020), and Wave 3 (December 2020) in our community-dwelling adult sample are summarized in Table 1. Cronbach's alpha values for the ITQ PTSD diagnoses were 0.78, 0.88, and 0.86 at Wave 1, Wave 2, and Wave 3, respectively. Interestingly, the PTSD base rate estimate at Wave 1 did not differ significantly from the PTSD base rate (n = 100, 12.3%) in the original cross-sectional sample ($N = 811$), χ^2 (1) = 0.56, $p > .50$, $\varphi = 0.03$.

The PTSD base rate estimates did not significantly differ across the three waves of our study, Cochran's *Q* (2) = 1.02, $p > .50$, $\eta^2_Q = 0.00$. Across the three waves, a total of 47 (23.2%) participants met the ICD-11 criteria for PTSD based on ITQ self-reports; however, only six (3.0%) participants consistently met criteria for PTSD diagnosis from Wave 1 to Wave 3. Absence of clinically relevant distress on all ICD-11 PTSD symptom clusters (i.e., re-experiencing of the trauma, avoidance of traumatic remainders, and sense of threat) at later waves was observed only for four (9.1%) PTSD participants from Wave 1 to Wave 2, and six (27.3%) PTSD participants from Wave 1 to Wave 3; none (0.0%) of the participants who received an ITQ PTSD diagnosis at Wave 2 showed absence of clinically relevant distress on all ICD-11 PTSD symptom clusters at Wave 3.

The descriptive statistics, Cronbach's alpha values, and inter-correlations for the PID-5-36 domain scales and the *DSM-5* Level 2 Acute Stress, Dissociation, Anxiety and Depression scales in the full sample are listed in the Supplementary Material (Table S2). On average, a moderate overlap was observed among the Wave 1 PID-5-36 domain scale scores, median *r* value = 0.33, *SD* = 0.11. The median inter-correlations among the four *DSM-5* Level 2 scale scores were 0.51 (*SD* = 0.15), 0.64 (*SD* = 0.18), and 0.59 (*SD* = 0.14). Median test-retest *r* values across the three waves were 0.64 (*SD* = 0.08), 0.55 (*SD* = 0.05), 0.53 (*SD* = 0.05), and 0.59 (*SD* = 0.05) for the *DSM-5* Level 2 Acute Stress, Dissociation, Anxiety and Depression scales. The median *r* values between different *DSM-5* Level 2 scale scores in different waves (e.g., between Wave 1 Dissociation scale score and Wave 2 Anxiety scale score) were 0.40 (*SD* = 0.06, min. *r* = 0.29, max. *r* = 0.48, all *p*s < .001), 0.31 (*SD* = 0.08, min. *r* = 0.23, max. *r* = 0.50, all *p*s < .001), 0.39 (*SD* = 0.09, min. *r* = 0.30, max. *r* = 0.54, all *p*s < .001), and 0.47 (*SD* = 0.09, min. *r* = 0.30, max. *r* = 0.63, all *p*s < .001) for the *DSM-5* Level 2 Acute Stress, Dissociation, Anxiety, and Depression scales, respectively.

The descriptive statistics for the PID-5-36 domain scales and the *DSM-5* Level 2 Acute Stress, Dissociation, Anxiety, and Depression scales broken down by PTSD diagnosis across the three waves are listed in the Supplementary Material (Table S3). The area under the curve values (based on receiver operating characteristic analyses) and multiple logistic regression odds ratio estimates for the *DSM-5* Level 2 Acute Stress, Dissociation, Anxiety, and Depression scale scores and PID-5-36 domain scale scores as predictors of COVID-19 related PTSD diagnoses in the three waves are summarized in Table 2. Considering the PID-5-36 predictors, the condition index value was 7.95 and all variance inflation factors were in the 1.30–1.49 range. Multicollinearity diagnostics for the *DSM-5* Level 2 scales showed condition index values of 13.68, 14.50, and 13.15 at Wave 1, Wave 2 and Wave 3, respectively; all condition index values were well below the 30.00 cut-off value for severe multicollinearity (cite for 30 cutoff). Similarly, all variance inflation factor values ranged from 1.48 (Wave 1 Dissociation scale) to 4.12 (Wave 2 Anxiety scale).

4. Discussion

To the best of our knowledge, our study represents the first attempt at providing data on the prevalence and course of COVID-19 related PTSD diagnosis in community dwelling adults, at least when the ITQ self-reports based on online surveys were used to assess the ICD-11 PTSD

Table 1
International trauma questionnaire COVID-19 related post-traumatic stress disorder diagnosis: Base rate estimates and diagnostic stability statistics across Wave 1, Wave 2, and Wave 3 in Italian community dwelling adults (N = 203).

Wave 1 (March 2020)	Wave 2 (June 2020) PTSD - n (%)	Wave 2 (June 2020) PTSD + n (%)	n (%)	Wave 3 (December 2020) PTSD - n (%)	Wave 3 (December 2020) PTSD + n (%)	n (%)	Wave 2 (June 2020)	Wave 3 (December 2020) PTSD - n (%)	Wave 3 (December 2020) PTSD + n (%)	n (%)
PTSD -	165 (81.3)	16 (7.9)[1]	181 (89.2)	169 (83.3)	12 (5.9)[2]	181 (89.2)	PTSD -	165 (81.3)	12 (5.9)[3]	177 (87.2)
PTSD +	12 (5.9)[1]	10 (4.9)	22 (10.8)	13 (6.4)[2]	9 (4.4)	22 (10.8)	PTSD +	17 (8.4)[3]	9 (4.4)	26 (12.8)
n (%)	177 (87.2)	26 (12.8)		182 (89.7)	21 (10.3)		n (%)	182 (89.7)	21 (10.3)	
Cohen's κ		.34***			.35***				.30***	
RR		5.14			6.17				5.11	
95% CI	2.67	9.89		2.94	12.96			2.39	10.92	

Note. PTSD -: No post-traumatic stress disorder diagnosis; PTSD +: Presence of post-traumatic stress disorder diagnosis; RR: Relative risk; 95% CI: 95% confidence interval.
1: McNemar's $\chi^2(1) = 0.32$, $p > .50$, Cohen's $h = 0.04$; 2: McNemar's $\chi^2(1) = 0.00$, $p > .90$, Cohen's $h = 0.01$; 3: McNemar's $\chi^2(1) = 0.55$, $p > .40$, Cohen's $h = 0.05$. ***$p < 001$.

Table 2
Post-traumatic stress disorder diagnosis and DSM-5 level 2 acute stress, dissociation, anxiety, and depression scale scores and PID-5-36 domain scale scores: Area under the curve values (based on receiver operating characteristic analyses) and multiple logistic regression odds ratio estimates in the full sample (N = 203).

Wave 1 (March 2020)	Wave 1 (March 2020) PTSD + (n = 22)[1] AUC	OR	95% CI		Wave 2 (June 2020) PTSD + (n = 26)[2] AUC	OR	95% CI		Wave 3 (December 2020) PTSD + (n = 21)[3] AUC	OR	95% CI	
DSM-5 Level 2 Scales												
Acute stress	**.89**	<u>5.32</u>	2.28	12.44	**.82**	<u>4.08</u>	1.89	8.79	**.73**	<u>2.40</u>	1.11	5.21
Dissociation	**.72**	0.62	0.18	2.13	**.66**	0.66	0.22	2.03	.66	0.92	0.29	2.93
Anxiety	**.80**	1.02	0.88	1.18	**.79**	1.12	0.99	1.28	.69	0.95	0.84	1.09
Depression	**.82**	<u>1.13</u>	1.00	1.29	**.74**	1.01	0.91	1.13	**.75**	1.12	1.00	1.27
McFadden R^2		.34***				.25***				.15***		
PID-5-36 Scales												
Negative Affectivity	**.76**	<u>3.82</u>	1.57	9.31	**.70**	<u>3.43</u>	1.53	7.70	**.80**	<u>4.91</u>	1.90	12.69
Detachment	.58	1.75	0.61	5.00	.59	1.96	0.75	5.10	.52	0.66	0.22	2.04
Antagonism	.52	0.31	0.09	1.13	.50	0.40	0.13	1.26	.57	0.40	0.11	1.38
Disinhibition	.60	0.93	0.30	2.90	.54	0.80	0.28	2.28	**.68**	2.92	0.92	9.31
Psychoticism	**.70**	<u>2.42</u>	1.03	5.67	**.67**	1.80	0.82	3.97	**.71**	<u>2.75</u>	1.13	6.69
Anankastia	.66	1.41	0.67	2.95	.61	1.13	0.58	2.20	.58	0.85	0.39	1.85
McFadden R^2		.17***				.12***				.23***		
Wave 2 (June 2020)												
Acute stress	–	–		–	**.96**	<u>19.97</u>	5.47	72.86	**.77**	2.23	0.92	5.44
Dissociation	–	–		–	**.72**	0.34	0.11	1.11	**.69**	1.88	0.74	4.79
Anxiety	–	–		–	**.90**	1.19	0.98	1.44	**.74**	1.05	0.90	1.22
Depression	–	–		–	**.86**	0.94	0.81	1.09	**.70**	0.99	0.87	1.12
McFadden R^2		–				.56***				18***		
Wave 3 (December 2020)												
Acute stress	–	–		–	–	–		–	**.93**	<u>14.88</u>	3.96	55.83
Dissociation	–	–		–	–	–		–	**.79**	1.57	0.46	5.41
Anxiety	–	–		–	–	–		–	**.84**	1.22	0.99	1.50
Depression	–	–		–	–	–		–	**.83**	0.88	0.75	1.03
McFadden R^2		–				–				.47***		

Note. PTSD +: Presence of post-traumatic stress disorder diagnosis; 1: Absence of post-traumatic stress disorder diagnosis: n = 181; 2: Absence of post-traumatic stress disorder diagnosis: n = 177; 3: Absence of post-traumatic stress disorder diagnosis: n = 182; AUC: Area under the curve values; PID-5-36: Personality Disorder for DSM-5-36; OR: Odds ratio; 95% CI: 95% confidence interval; –: Statistic not computed. In bivariate association (i.e., AUC) analyses, for each set of predictors the nominal significance level (i.e., $p < .05$) was corrected according to the Bonferroni procedure and set at $p < .0125$ for the DSM-5 Level 2 scales, and at $p < .008$ for the PID-5-36 scales. Bold highlights Bonferroni-significant AUC values; significant OR values are underlined.

criteria. Although the longitudinal sample size was modest, we feel that our findings could be useful for planning programs for assessing, treating, and even preventing PTSD onset in COVID-19 exposed community dwelling adults. It should be observed that the Wave 1 PTSD prevalence that was observed in our longitudinal sample did not differ significantly from the PTSD base rate estimate that was reported in our 811-participant cross-sectional sample; this finding, as well as the lack of other significant difference between the two samples, supports the generalization of our longitudinal findings at least to Italian community-dwelling adults.

According to our findings, the point prevalence estimates of COVID-19 related PTSD at each wave were all in the 11%–13% of the participants; however, it should be observed that up to roughly 23% of our

participants experienced clinically relevant PTSD features during nine months of the COVID-19 pandemic in Italy, at least according to the ITQ self-reports. According to our data, the point-prevalence estimates of the COVID-19 PTSD diagnosis were not significantly different across the three waves of our study. These findings are consistent with extant literature on the COVID-19 related PTSD prevalence in community dwelling adults (Xiong et al., 2020), and support the need for longitudinal psychiatric evaluation for capturing the real impact of the COVID-19 pandemic on mental health in exposed populations. These findings are consistent with dimensional representation of PTSD and may suggest the development of a phobic response that overlaps with PTSD features, or the development of coping strategies that help managing the COVID-19 distress (e.g., Nikčević and Spada, 2020).

Our relative risk data clearly indicated that meeting the criteria for PTSD diagnosis at the preceding wave represented a substantial risk factor for scoring positive on the ITQ for COVID-19 related PTSD also at later waves; indeed, participants who scored positive on the ITQ for COVID-19 related PTSD at the preceding wave were 5–6 times more likely than non-PTSD participants to qualify for COVID-19 related PTSD at later waves. This result is consistent with extant literature (Cooper et al., 2020) strongly stressing the need for preventive intervention for reducing the impact of COVID-19 related stress reactions in community dwelling adults, at least in Italy.

Notwithstanding these findings, our data showed that the temporal consistency estimates (i.e., Cohen's kappa values) of the COVID-19 related PTSD diagnosis from Wave 1 to Wave 3 were at best modest. Indeed, an approximately similar frequency of PTSD onset and PTSD remission were observed from March 2020 to June 2020, and from June 2020 to December 2020. Although remissions of PTSD seemed to occur in our sample across the different study waves, absence of clinically relevant distress on all ICD-11 PTSD symptom clusters was observed only in a minority of PTSD participants. This finding seems at least partially consistent with recent data on population resilience with respect to the COVID-19 as a traumatic stressor (Rutherford et al., 2021), while suggesting the need for careful PTSD assessment and early intervention in exposed populations. Moreover, it seems also to suggest the need for dimensional models of PTSD to capture the impact on mental health of the COVID-19 pandemic as a stressor, because most of our PTSD participants seemed to experience remission from PTSD diagnosis while showing clinically relevant PTSD features in at least one symptom cluster.

According to our bivariate and multivariate association analysis results, both internalizing psychopathology (i.e., acute stress, dissociation, anxiety, and depression) and selected dysfunctional personality dimensions were significantly and substantially associated with COVID-19 related PTSD diagnosis across the three waves of the study, at least when they were assessed using the *DSM-5* Level 2 scales and the PID-5-36 self-reports. In particular, multiple logistic regression results suggested that the participant's level of acute stress in March 2020 was a significant and non-trivial risk factor for COVID-19 related PTSD not only at Wave 1, but also in June 2020 (i.e., Wave 2) and December 2020 (i.e., Wave 3). This finding strongly stresses the relevance of careful assessment of acute stress reactions in order to prevent the long-term effects of COVID-19 on community-dwelling adults' mental health (Pattni et al., 2020).

The participant's propensity towards experiencing extreme and rapidly shifting negative emotions (i.e., *DSM-5*/ICD-11 Negative Affectivity; Krueger and Markon, 2014), and, to a lesser extent, the participant's disposition towards exhibiting a wide range of culturally incongruent odd, eccentric, or unusual behaviors and cognitions, including both process (e.g., perception, dissociation) and content (i.e., *DSM-5* Psychoticism; Krueger and Markon, 2014) represented the dysfunctional personality domains that were significantly and consistently predictive of COVID-19 related PTSD diagnosis in multiple logistic regression analyses both within and across Wave 1, Wave 2, and Wave 3, respectively. This finding is consistent with previous cross-sectional data (Mazza et al., 2020) on the role of personality on PTSD symptoms during COVID-19 pandemic. Moreover, our findings suggested the importance of considering individual differences in Negative Affectivity, both to evaluate the individual's risk for developing of PTSD symptoms, and as a treatment target to reduce the long-term consequences of psychological distress (e.g., Nikčević et al., 2021; O'Donnell et al., 2021).

Of course, our results should be considered in the light of several limitations. Our sample was composed of highly educated participants, mainly of female gender; these characteristics inherently limit the generalizability of our findings; moreover, the COVID-19 pandemic emergency did not allow us to track the reasons why participants dropped the study after agreeing to participate. We cannot rule out a possible selective inclusion of participants in our study. Indeed, our

participants were not randomly sampled from the Italian general population; rather they represented a convenient study group of adult volunteers, and this method aspect limits the generalizability of our findings. Moreover, our participants represented roughly 25% of the larger Wave 1 study group; although COVID-19 and related conditions may have had an impact on allowing participants to complete Wave 3 assessments, we cannot rule out that other self-selection biases took place. However, no systematic differences were observed between Wave 1 and Wave 3 participants on relevant demographic variables.

We relied exclusively on self-report questionnaires, with no possibility to rely on direct observations or expert interviews/ratings. Further studies based on different methods of assessment are badly need before accepting our findings. In the attempt to facilitate subjects' participation in our on-line longitudinal study, we had to rely on short measures and to limit the number of demographic variables that were assessed in the present study; future studies should focus on the role of socio-demographic variables in order to evaluate their role in shaping individual responses to the COVID-19 pandemic.

Even keeping these limitations in mind, we think that our study extended previous knowledge on the COVID-19 pandemic as a post-traumatic stressor providing longitudinal eed for implementing preventive intervention in order to avoid chronic COVID-19 related PTSD, at least among community-dwelling Italian participants. Moreover, our findings suggested that personality maladaptive personality traits assessment may provide clinically-relevant information as to the development of COVID-19 related PTSD.

Declaration of competing interest

The authors report no conflicts of interest in this work.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jpsychires.2021.06.024.

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