

Volume 9, n 1, 2021

Articles

An empirical model for understanding the threat responses at the time of COVID-19

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Abstract

**Background:** The COVID-19 pandemic represents a global challenge which may have pervasive effects in several areas of community and individual life. Consequently, the virus could generate fear and anxiety that must be managed in a new and unknown situation, such as that of lockdown, with potential consequences for mental health outcomes. Therefore, with the theoretical guide of the Polyvagal perspective, this research aimed to analyse the mediation of social support, passive aggression, avoidance and dissociation in the relationship between fear and anxiety during the COVID-19 pandemic.

**Methods:** During the national COVID-19 lockdown phase, a sample of 992 Italian participants with a mean age of 35.07 years ( $SD = 12.11$ ) completed the Ten Penn State Worry Questionnaire, State-Trait Anxiety Inventory – Form X3, Coping Orientation to Problems Experienced and Forty Item Defense Style Questionnaire, after providing written informed consent.

**Results:** Results showed that fear affected anxiety, both directly and indirectly, highlighting a serial multiple mediation model with two parallel chain of mediators. Social support coping strategy negatively influenced fear and passive aggression, which instead were positively associated. Furthermore, in the second chain, avoidance directly induced fear in the presence of anxiety, opposite of dissociation defense mechanism.

**Conclusions:** Such findings highlighted some possible answers that could be implemented as a consequence of the fear perception during the COVID-19 lockdown, according to the framework of the Polyvagal Theory. These data could provide an important contribution in shedding light on mechanisms put in place during the pandemic, promoting valuable information for a more effective clinical practice.

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**Keywords:**

Anxiety; Fear; COVID-19; Polyvagal Theory; SARS-CoV-2.

**Received:** 30 Dicembre 2020

**Accepted:** 15 April 2021

**Published:** 29 April 2021

**Citation:** Gori, A., Topino, E., Craparo, G., Lauro Grotto, R., Caretti, V. (2021). An empirical model for understanding the threat responses at the time of COVID-19. *Mediterranean Journal of Clinical Psychology*, 9(1).

<https://doi.org/10.6092/2282-1619/mjcp-2916>

## 1. Introduction

The COVID-19 is a viral infection caused by the new Coronavirus SARS-CoV-2 (He et al., 2020), which has spread rapidly worldwide since it has been discovered in Wuhan in late December 2019. This pandemic represents a global challenge with large-scale direct and indirect pervasive effects in various areas, such as the financial (Duan & Zhu, 2020) and healthcare (Lai et al., 2020) ones, and at different levels, *i.e.*, international (Phelan et al., 2020), community (Shah et al., 2020) and individual (Brooks et al., 2020; Settineri & Merlo, 2020). Given the extent of the situation, several research drew attention to the consequences for mental health (Di Giacomo, 2020), highlighting how such imposing events may have long-term negative impacts that could persist even after the emergency is over (Kothari et al., 2020; Koushik, 2020; Lima et al., 2020; Reardon, 2015): interpersonal difficulties (Pietrabissa & Simpson, 2020; Verdon & Racin, 2020), stress, depression, post traumatic symptoms (Passavanti et al., 2021), and sleep disorders (Somma et al., 2020) are just some of the effect detected during the COVID-19 outbreak. Furthermore, with the explosion of the pandemic, a parallel burst of fear and anxiety is spreading. Both these constructs denote a perceived threat response, but different criteria allow a clear distinction (Heeren, 2020; Presti et al., 2020; Starcevic et al., 2020). Fear is present-oriented, sudden, acute and short-lived, and involves several biological processes linked to the preparation for a response to immediate and potentially threatening events, thus resulting an adaptive defense mechanism essential for survival (Heeren, 2020; Schimmenti et al., 2020). However, when it is chronic or disproportionate, it becomes harmful and can be a key component in the development of several psychiatric disorders (Garcia, 2017). The characteristics of COVID-19 (such as its spread through an invisible and impalpable virus), the uncertainty about patient outcomes, the isolation, and the mandatory change of habits imposed by governments to protect the physical health of the population have brought people all over the world to experience a pervasive sense of fear (Soraci et al., 2020), responsible in turn for an intensification of psychological symptoms in individuals with pre-existing psychiatric disorders and for high levels of stress and anxiety in healthy subjects, further amplifying the harm of the disease itself (Shigemura et al., 2020). On the other hand, anxiety is future-oriented, with a gradual onset, a chronic course, a longer duration, and implies a cognitive re-evaluation of the fear: it could be defined as an emotional state “*characterized by subjective consciously perceived feelings of tension and apprehension*” (Spielberger et al., 1983, p. 8) and resulting from the anticipation of a real or perceived threatening event or situation (Spielberger, 2010). Just like fear, it has the function of defending an organism from possible threats (see, for a review, McNaughton & Corr, 2004), but it can become dysfunctional if prolonged for extended periods (Tanner, 2012). Disease outbreaks such as the COVID-19 emergency can favour the emergence of anxiety states

(Benassi et al., 2020; Labrague & De los Santos, 2020); indeed, in the context of the pandemic, Wang et al. (2020) found that a relevant percentage of respondents reported clinically relevant anxiety levels, which had a significant impact on quality of life (Huang & Zhao, 2020): higher levels of coronavirus anxiety were strongly, positively associated with functional impairment, alcohol or drug coping, negative religious coping, extreme hopelessness, and passive suicidal ideation (Lee, 2020). Therefore, on the base of the above-described scenario, the present study aims to achieve better understanding of the path from fear to anxiety in individuals who are experiencing the lockdown due to the COVID-19 global pandemic, exploring the role of several coping strategies and defense mechanisms in influencing this relationship.

In this regard, Porges provides with the Polyvagal Theory a neurobiological model to explain the responses to face potentially threatening stimuli in cycles of engagement, mobilization and disconnection associated with the activity of the autonomic nervous system (Porges, 2009, 2011). The author explains that, in situations perceived as dangerous, the first implemented strategy implies an attempt to restore a state of safety through a co-regulation and involves the ventral-vagal circuit, myelinated and phylogenetically the most recent, linked to the ability to express emotions with the face, the voice, the prosody and the breath. In case of failure of social engagement attempts, the sympathetic system regulates metabolic capacity and heart rate predisposing the body to fight or flight reactions functional to survival. Finally, when these modalities are not useful or are not practicable, one last defensive response remains to be put in place, promoted by the most ancient dorsal-vagal system: freezing and shut down. In this way, Porges (2009, 2011) describes the responses to danger on a continuum of interaction with the outside world linked to the perception of availability and the effectiveness of existing resources.

This theoretical perspective is also reflected in further studies that highlight the effects of the different strategies implemented in response to stressful situations. Scientific literature, indeed, supports the protective role of social engagement due to the ventral-vagal circuit, indicating that the coping based on social support was negatively associated to post-traumatic symptoms, and positively related to post-traumatic growth (Dworkin et al., 2018; Gori et al., 2021a, 2021b). Consistently, perceived social support may have a protective role for psychological diseases, by reducing the perception of threat and increasing the one of having the necessary resources to face difficulties (Alessandri et al., 2012): indeed, perceived social support was positively associated with mental health (Harandi et al., 2017).

Concerning the sympathetic reactions, the fight or flight from the COVID-19, the “invisible enemy” (Shaw, 2020), could manifest itself with passive aggression or avoidance coping. The

first one may be described as a resistance or resentment towards authority, demands, responsibility through passivity (Segal et al., 2007), and was associated to stress, somatization, anxiety, depression and post-traumatic symptoms (Jun et al., 2015; Segal et al., 2007). On the other hand, avoidance coping is a way to deal with difficulties by making efforts to escape, avoid, or distract themselves from the situation (Folkman & Moskowitz, 2004). This may be functional in the short term, but previous studies showed its maladaptive effect in reducing negative emotions in the long term (Gross & Thompson, 2007; John & Gross, 2004). Finally, when the parasympathetically dominated shut down was the prominent peritraumatic response, the subject tried to protect itself through dissociative experiences. Dissociation is ‘*a disruption of and/or discontinuity in the normal integration of consciousness, memory, identity, emotion, perception, body representation, motor control, and behavior*’ (APA, 2013, p. 291). In other words, it could be seen as a defence mechanism based on the psychological detachment from painful and traumatogenic events that may be difficult to process (van der Hart et al., 2006).

### 1.1 Objectives of the study

Previous research highlighted the usefulness of the Polyvagal Theory to understand reactions in response to signals of risk as well as safety (Porges, 2013). This also provided a lens to favour insights on aspects such as psychopathology (*e.g.*, Austin et al., 2007), interpersonal problems (Bailey et al., 2020), the ethology of emotional dysregulation (Beauchaine et al., 2007), traumatogenic experiences and physical diseases (Kolacz et al., 2019). Given this theoretical framework, this study aimed to apply and deepen the fear responses outlined by the Porges’ Polyvagal Theory in the COVID-19 pandemic context. Therefore, the mediation of social support, passive aggression, avoidance and dissociation in the relationship between fear and anxiety was explored. More specially, a serial multiple mediation model with two parallel chain of mediators was carried out, by hypothesizing that:

**H1:** Fear correlates with Anxiety;

**H2:** Fear is related with Social Support and Passive Aggression, the mediator variables of the first chain;

**H3:** Social Support and Passive Aggression affect Anxiety;

**H4:** Fear is related with Avoidance and Dissociation, the mediator variables of the second chain;

**H5:** Avoidance and Dissociation affect Anxiety;

**H6:** The effect of Fear on Anxiety is mediated by Social Support, Passive Aggression, Avoidance, Dissociation.

These steps were used to analyze the effect of Fear on Anxiety, controlling for Social Support, Passive Aggression, Avoidance, Dissociation.

## 2. Method

### 2.1 Participants and procedure

The sample consisted of 992 individuals (31.4% men and 68.6% women) with an age ranging from 18 to 72 ( $M = 35.07$ ;  $SD = 12.11$ ), which completed a web-based survey on Google Form platform. Respondents were recruited through a snowball-like procedure and privacy and anonymity have been guaranteed. They were informed of the objectives of the study and provided informed consent electronically before starting. Their participation in the study was voluntary: no compensation was given for involvement in the research and they were free to leave at any time. The survey was launched during the first Italian lockdown due to COVID-19 pandemic.

### 2.2 Measures

#### *Penn State Worry Questionnaire (PSWQ)*

The Penn State Worry Questionnaire (PSWQ; Meyer et al., 1990) is a 16-items self-report measure considered the gold-standard assessment instrument for pervasive and uncontrollable worry and fear. All items are rated on a 5-point Likert scale from 1 (= “not at all typical”) to 5 (= “very typical”). The Italian version of Meloni and Grana (2001) was used for this study, showing to have excellent reliability in the present sample ( $\alpha = .93$ ).

#### *State-Trait Anxiety Inventory – Form X3 (STAI – X3)*

The State-Trait Anxiety Inventory – Form X (STAI – X; Spielberger et al., 1970) is a self-report measure to assess state or trait anxiety. In this study, the short Italian X3 version of Vidotto and Bertolotti (1991) was used, consisting of 10 items evaluating state anxiety and rated on a 4-point Likert scale (from 1 = “Not at all” to 4 = “Very much so”). In the present sample, it showed a excellent internal consistency, with a Cronbach’s  $\alpha = .93$ .

#### *Coping Orientation to Problems Experienced - New Italian Version (COPE-NVI)*

The Coping Orientations to Problems Experienced (COPE; Carver et al., 1989) is a 60-items self-report questionnaire to assess the use of various coping styles in stressful situations. In this study, the *Coping Orientation to Problems Experienced - New Italian Version (COPE-NVI; Sica et al., 2008)*. All the items are scored on a 4- point Likert scale (from 1 = “I don't usually do this at all” to 4 = “I usually do this”), grouped in 5 dimensions, with a good internal consistency in the present sample: 1) Social Support (12 items,  $\alpha = .90$ ), that is the search for emotional (e.g., emotional outburst or search for understanding) or instrumental (e.g., search for information) social support; 2) Avoidance Strategies (16 items,  $\alpha = .80$ ), including denial, behavioural

disengagement and mental disengagement; 3) Positive Attitude (12 items, e.g.,  $\alpha = .79$ ), including positive reinterpretation, acceptance and restraint; 4) Approach Coping (12 items, e.g.,  $\alpha = .85$ ), including active coping, planning, and suppression of competing activities; 5) Turning to Religion (8 items,  $\alpha = .83$ ), indicating the tendency to see religion as a source of emotional support or a vehicle for growth.

#### *Forty Item Defense Style Questionnaire (DSQ – 40)*

The Forty Item Defense Style Questionnaire (DSQ – 40; Andrews et al., 1993) is a 40-items self-report measure to assess defense mechanism. In the present study, the Italian version of Farma and Cortinovis (2000) was used. All the items scored on a 9- point Likert scale (from 1 = “*Strongly disagree*” to 9 = “*Strongly agree*”) and indicates 20 defense mechanism (two items of each one). These, in turn, are organized into three sub-factors: 1) Mature defense style (8 items,  $\alpha = .55$ ), consisting of sublimation, humor, anticipation, and suppression; 2) Neurotic defenses style (8 items,  $\alpha = .60$ ), consisting of undoing, pseudo-altruism, idealization, and reaction formation; 3) Immature defense style (24 items,  $\alpha = .82$ ), consisting of projection, acting out, isolation, devaluation, autistic fantasy, denial, passive aggression, displacement, disassociation, splitting, rationalization, and somatization.

### **2.3 Data Analysis**

Collected data were analysed with the SPSS software (IBM-SPSS 25.0 version, IBM, Armonk, NY, USA) for Windows. Firstly, descriptive statistics for the sample were calculated. Then, Pearson’s  $r$  correlations were used to investigate the associations between the variables. The hypothesized model was analyzed using macro-program PROCESS 3.4 (Hayes, 2018) applying model 82. Finally, to test the significance of the indirect effect, the bootstrapping technique for each of 5,000 bootstrapped samples with the 95% of confidence interval was implemented.

### **3. Results**

Pearson’s correlation and descriptive statistics for all the variables are shown in table 1.

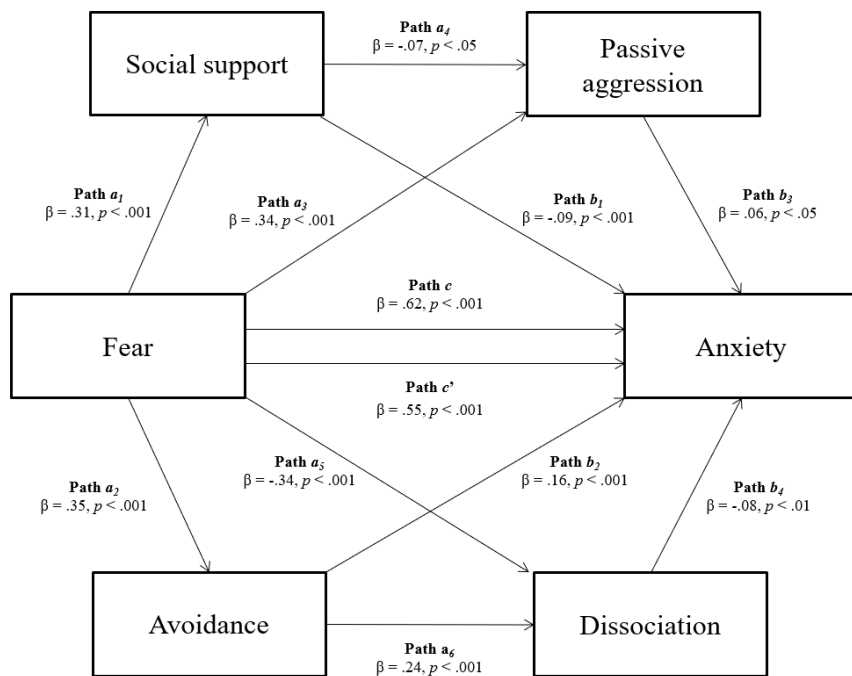
**Table 1.** Means, standard deviations and correlations between the variables

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
1. PSWQ	1																										
2. STAI-X3	.621**	1																									
3. COPE-NVI (1)	.315**	.116**	1																								
4. COPE-NVI (2)	.345**	.360**	.122**	1																							
5. COPE-NVI (3)	-.111**	-.166**	.262**	.042	1																						
6. COPE-NVI (4)	-.032	-.158**	.337**	-.060	.772**	1																					
7. COPE-NVI (5)	.191**	.140**	.131**	-.066*	-.022	-.060	1																				
8. DSQ40 (1.1)	.100**	-.004	.232**	.108**	.227**	.232**	.056	1																			
9. DSQ40 (1.2)	-.363**	-.289**	-.017	-.086**	.308**	.249**	-.350**	.128**	1																		
10. DSQ40 (1.3)	.143**	.092**	.103**	.158**	.271**	.265**	-.027	.235**	.137**	1																	
11. DSQ40 (1.4)	-.239**	-.125**	-.166**	.077*	.202**	.147**	-.087**	.087**	.275**	.200**	1																
12. DSQ40 (2.1)	.190**	.193**	.114**	.226**	.187**	.145**	.100**	.248**	.063*	.287**	.104**	1															
13. DSQ40 (2.2)	.389**	.309**	.281**	.295**	.092**	.100**	.079*	.267**	-.039	.242**	-.002	.289**	1														
14. DSQ40 (2.3)	.240**	.150**	.164**	.206**	.111**	.032	.138**	.189**	.005	.289**	.115**	.274**	.318**	1													
15. DSQ40 (2.4)	.134**	.091**	.137**	.105**	.161**	.068*	.051	.141**	.101**	.206**	.092**	.247**	.269**	.287**	1												
16. DSQ40 (3.1)	.418**	.378**	-.005	.361**	-.068*	-.078*	-.048	.078*	-.147**	.205**	-.008	.259**	.282**	.211**	.197**	1											
17. DSQ40 (3.2)	.319**	.292**	.035	.411**	-.073*	-.106**	-.008	.048	-.141**	.174**	.088**	.254**	.307**	.280**	.120**	.462**	1										
18. DSQ40 (3.3)	.393**	.366**	.124**	.342**	-.120**	-.067*	.042	.038	-.132**	.138**	-.034	.227**	.251**	.280**	.039	.332**	.382**	1									
19. DSQ40 (3.4)	.111**	.162**	-.298**	.282**	-.046	-.071*	-.093**	.005	.002	.275**	.281**	.120**	.120**	.128**	.065*	.311**	.334**	.246**	1								
20. DSQ40 (3.5)	.014	.042	-.100**	.155**	.146**	.121**	-.037	.075*	.110**	.251**	.208**	.201**	.127**	.138**	.135**	.159**	.198**	.159**	.293**	1							
21. DSQ40 (3.6)	.380**	.290**	.041	.473**	-.024	-.086**	-.019	.075*	-.076*	.207**	-.001	.198**	.281**	.244**	.138**	.431**	.399**	.345**	.322**	.221**	1						
22. DSQ40 (3.7)	-.123**	-.028	-.152**	.224**	.052	.020	-.067*	.006	.154**	.154**	.286**	.188**	.051	.186**	.143**	.163**	.247**	.183**	.343**	.239**	.187**	1					
23. DSQ40 (3.8)	.289**	.255**	.078*	.287**	-.036	-.045	.028	.120**	-.083**	.152**	.010	.467**	.252**	.205**	.132**	.289**	.309**	.260**	.165**	.125**	.280**	.110**	1				
24. DSQ40 (3.9)	-.256**	-.177**	-.125**	.121**	.168**	.144**	-.145**	.090**	.284**	.153**	.318**	.177**	.036	.147**	.112**	.053	.166**	.109**	.237**	.282**	.107**	.567**	.078*	1			
25. DSQ40 (3.10)	.237**	.222**	.029	.305**	.018	-.002	.137**	.073*	-.082**	.184**	.137**	.236**	.170**	.376**	.103**	.272**	.322**	.411**	.230**	.185**	.288**	.269**	.200**	.205**	1		
26. DSQ40 (3.11)	-.244**	-.266**	.038	-.006	.321**	.289**	-.010	.214**	.375**	.212**	.295**	.174**	.040	.083**	.111**	-.120**	-.031	.012	.022	.280**	.004	.277**	-.018	.476**	.096**	1	
27. DSQ40 (3.12)	.460**	.404**	.162**	.339**	-.017	-.033	.119**	.133**	-.119**	.159**	-.011	.320**	.318**	.286**	.165**	.311**	.348**	.425**	.161**	.145**	.314**	.082**	.323**	-.015	.232**	-.025	1
<i>M</i>	46.99	2.64	3.52	26.05	3.73	3.81	18.86	1.29	12.74	1.89	9.58	7.72	8.78	8.26	9.15	7.16	7.95	9.50	8.77	8.66	8.4	5.51	7.31	6.92	7.70	1.33	7.67
<i>SD</i>	14.01	7.71	8.11	6.340	5.340	6.33	4.97	4.23	3.87	3.27	3.67	3.32	3.57	4.16	3.61	3.87	4.14	4.14	4.81	3.12	4.94	3.47	3.71	3.37	4.43	3.40	4.38

Note: \*\*. Correlation is significant at the .01 level (2-tailed). \*. Correlation is significant at the .05 level (2-tailed). PSWQ = Italian PSWQ total score; STAI-X3 = Italian STAI-X3 total score; COPE-NVI (1) = Social Support; COPE-NVI (2) = Avoidance Strategies; COPE-NVI (3) = Positive Attitude; COPE-NVI (4) = Planning Activity; COPE-NVI (5) = Turning To Religion; DSQ40 (1.1) = Sublimation; DSQ40 (1.2) = Humor; DSQ40 (1.3) = Anticipation; DSQ40 (1.4) = Suppression; DSQ40 (2.1) = Undoing; DSQ40 (2.2) = Pseudo-Altruism; DSQ40 (2.3) = Idealization; DSQ40 (2.4) = Reaction Formation; DSQ40 (3.1) = Projection; DSQ40 (3.2) = Passive Aggression; DSQ40 (3.3) = Acting Out; DSQ40 (3.4) = Isolation; DSQ40 (3.5) = Devaluation; DSQ40 (3.6) = Autistic Fantasy; DSQ40 (3.7) = Denial; DSQ40 (3.8) = Displacement; DSQ40 (3.9) = Dissociation; DSQ40 (3.10) = Splitting; DSQ40 (3.11) = Rationalization; DSQ40 (3.12) = Somatization.

Concerning the serial multiple mediation analysis with two parallel chain of mediators, results confirmed the relationship between fear and anxiety (path  $c$  in Figure 1;  $\beta = 0.62, p < .001$ , Boot LLCI = 0.315–Boot ULCI = 0.369; **H1**), in which social support and passive aggression were sequential mediators, parallel to avoidance and dissociation.

**Figure 1.** A serial multiple mediation model with two parallel chain of mediators analysing the mediation of social support, passive aggression, avoidance and dissociation on the relationship between fear and anxiety



Specifically, fear affected both social support (path  $a_1$ ;  $\beta = 0.31, p < .001$ , Boot LLCI = 0.148–Boot ULCI = 0.217) and passive aggression (path  $a_3$ ;  $\beta = 0.34, p < .001$ , Boot LLCI = 0.083–Boot ULCI = 0.119), the mediators of the first chain (**H2**). They were negatively linked each other (path  $a_4$ ;  $\beta = -0.07, p < .05$ , Boot LLCI = -0.069–Boot ULCI = -0.005) and, in turn, they had a significant impact on Anxiety (path  $b_1$  with  $\beta = -0.09, p < .001$ , Boot LLCI = -0.133–Boot ULCI = -0.038 and path  $b_3$  with  $\beta = 0.06, p < .05$ , Boot LLCI = 0.018–Boot ULCI = 0.222 respectively; **H3**). Furthermore, fear also affected of both avoidance (path  $a_2$ ;  $\beta = 0.35, p < .001$ , Boot LLCI = 0.130–Boot ULCI = 0.183) and dissociation (path  $a_5$ ;  $\beta = -0.34, p < .001$ , Boot LLCI = -0.096–Boot ULCI = -0.066), the mediators of the second chain (**H4**). These two were positively linked each other (path  $a_6$ ;  $\beta = 0.24, p < .001$ , Boot LLCI = 0.093–Boot ULCI = 0.159) and, in turn, they had a significant impact on anxiety (path  $b_2$  with  $\beta = 0.16, p < .001$ , Boot LLCI = 0.132–Boot ULCI = 0.265 and path  $b_4$  with  $\beta = -0.08, p < .001$ , Boot LLCI = -0.294–Boot ULCI = -0.058, respectively; **H5**). So, the effect of fear on anxiety was reduced



after controlling social support, passive aggression, avoidance and dissociation (path  $c'$ ), but it was still significant ( $\beta = 0.55, p < .001$ , Boot LLCI = 0.273–Boot ULCI = 0.336), suggesting a partial mediation:  $R^2 = 0.424, F(5,986) = 145.281, p < 0.001$  (**H6**, see Table 2). Finally, the bootstrapping procedure confirmed the statistical stability of this serial multiple mediation model with two parallel chain of mediators and the significance of this indirect effect (Boot LLCI = 0.019–Boot ULCI = 0.058).

**Table 2.** The coefficients of the model

Antecedent	Consequent																			
	M1			M2			M3			M4			Y							
	Coeff.	SE	<i>p</i>	Coeff.	SE	<i>p</i>	Coeff.	SE	<i>p</i>	Coeff.	SE	<i>p</i>	Coeff.	SE	<i>p</i>					
X	$a_1$	.183	.018	< .001	$a_2$	.156	.014	< .001	$a_3$	.101	.001	< .001	$a_5$	-.081	.008	< .001	$c'$	.304	.016	< .001
M1	-	-	-	-	-	-	-	-	$a_4$	-.037	.016	.022	-	-	-	-	$b_1$	-.085	.024	< .001
M2	-	-	-	-	-	-	-	-	-	-	-	-	$a_6$	.126	.017	< .001	$b_2$	.198	.034	< .001
M3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	$b_3$	.120	.052	.021
M4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	$b_4$	-.176	.060	.004
Constant	$i_{M1}$	21.952	.856	< .001	$i_{M2}$	18.709	.663	< .001	$i_{M3}$	4.343	.561	< .001	$i_{M4}$	7.456	.475	< .001	$i_Y$	4.033	1.125	< .001
	$R^2 = .099$			$R^2 = .119$			$R^2 = .106$			$R^2 = .115$			$R^2 = .424$							
	$F(1, 990) = 108.893, p < .001$			$F(1, 990) = 133.754, p < .001$			$F(2, 989) = 58.867, p < .001$			$F(2, 989) = 64.329, p < .001$			$F(5, 986) = 145.281, p < .001$							

**Note:** X = Italian PSQW total score; M1 = Social Support coping strategy; M2 = Avoidance coping strategy; M3= Passive Aggression defense mechanism; M4 = Dissociation defense mechanism; Y = Italian STAI-X3 total score.

In Table 3, all the model's effects indices were summarized.

**Table 3.** Indices of model effects

Total Effect	Direct Effect	Indirect Effect	Partial Standardized Indirect Effect	Completely Standardized Indirect Effect	Bootstrapping 95% CI
.342	.304	.038	.004	.068	(.019, .058)

#### 4. Discussion

The Polyvagal Theory (Porges, 2009, 2011), by articulating an evolutionary hierarchy in the function of the autonomic nervous system to challenges, provides a map of the state of an organism facing any dangerous situations. Therefore, it could represent a guide for the understanding of emergent behavioural, emotional and physiological reactivity that individuals may have in coping with stressors, such as those linked to the spread of the SARS-CoV-2 virus (Porges, 2020). Following this perspective, the present research aimed to test the mediation of social support, passive aggression, avoidance and dissociation in the relationship between fear and anxiety during the COVID-19 pandemic.

Firstly, results harmonize with previous research (Shigemura et al., 2020) and confirmed the predictive role of fear in determining anxiety, with both direct and indirect paths. Despite the physical distancing measures put in place to protect against the virus, the data have shown that social support maintained its protective role frequently described in scientific literature (see, for a review, Guilaran et al., 2018), consistently with previous studies highlighting a significant negative association between perceived social support and SARS-CoV-2 anxiety (Skalski et al., 2021). This is a relevant result, further highlighting the human's social nature and the drive towards safe and mutual relationships for the maintenance of physical and emotional well-being (Seppala et al., 2013), and that reflects a strong push for collaboration and a great sense of compassion towards others in situations of community difficulty, already noted during previous epidemics (Chew et al., 2020). The effectiveness of the social engagement strategy was also highlighted by data in the hindering effect against the implementation of aggressive passive behaviours, which increased with fear and fuelled anxiety. The impossibility of directly fight the virus, in fact, could result in resistant responses to the new daily life changes imposed by the preventive measures (for example, missing online work meeting or leaving home excessively for no justified reason and incorrectly wearing the mask): this could amplify detachment from one's habits, thus catalysing the negative psychosocial impact of the restrictions and adding additional stress (Yanes et al., 2010) and anxiety (Jun et al., 2015). Moreover, since the virus is impalpable and invisible, it is not even possible to escape from it: so, results confirmed that the avoidance

strategy was induced by fear and in turn hesitated in greater levels of anxiety. This is consistent with previous studies about survivors to disasters from which it is not, by their nature, possible to move away, where higher levels of avoidance coping were associated with higher levels of cognitive and somatic anxiety (Dias et al., 2012), perceived stress and burnout (Polman et al., 2010), and poorer mental health outcomes (see, for a review, Brooks et al., 2017). Finally, the freezing: results showed that this response to danger is not fuelled not so much by fear in itself in a direct way, being the strategy less rapid and linked to the unmyelinated dorsal-vagal pathway, as much as by the failure of previous coping attempts, specifically the avoidance one. The inability to move away from the enemy leaves one last desperate alternative: dissociation and shut down. Data showed that this strategy could be functional in counteracting anxiety in extreme circumstances such as those related to COVID-19. Indeed, Porges (2009, 2011) explains that the freeze response aims to protect against psychological and physical pain: one of the neurological outcomes of this dorsal-vagal activity is the reduction of blood flow and oxygenation to the brain, which determines transformations in cognitive functions and dissociation experiences.

#### **4.1 Limitations and Future Directions**

This study has some limitations that should be kept in mind while interpreting the results. Firstly, given the impediments and limitations in resources due to the pandemic, a snowball-like procedure of sampling was used and the participants of the study may not fully represent the general population. Moreover, because of the cross-sectional nature of the study, no causal relationships could be carefully established. Although this research represents an important snapshot of the situation during the early stages of restrictive measures associated with the peak of diffusion of COVID-19 in Italy, it is also important to stress the need for a longitudinal perspective to confirm and extend the results. Finally, data were collected by the use of only self-report measures which are potentially susceptible to reporting biases. In future research, a multimodal approach could overcome this issue.

#### **5. Conclusion**

Despite the limitations described above, this study has presented useful pilot data for prevention and treatments, by providing a new empirical application of the Polyvagal Theory lens to understand the responses of the perceived treats due to the COVID-19 emergency. The pandemic carries with it consequences for mental health, highlighting the importance of the work of mental health professionals (Gruber et al., 2020; Mackolil & Mackolil, 2020) and timely, up-to-date interventions (Gamble et al., 2021) to promote positive and adaptive strategies for coping with distress (Gori et al., 2020; Urban & Urban, 2020). Furthermore, adequately

addressing mental health needs during and after COVID-19 requires an understanding of the nature and extent of the effects on psychological states. Polyvagal Theory informs both therapists and clients about the effect that threatening events can have on the autonomic nervous system and, consequently, on the psychology of individuals (Dana, 2018). The application of this theoretical framework in the real context of the COVID-19 pandemic may allow to shed light on the most relevant mechanisms associated with it, promoting valuable information for more effective clinical practice.

### **Conflict of Interest Statement**

The authors declare that the research was conducted in the absence of any potential conflict of interest.

### **Ethical standards**

The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008.

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**DOI:** 10.6092/2282-1619/mjcp-2916