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Conspiracy theories and COVID-19: Coping mechanism or cognitive dissonance? A longitudinal study

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Abstract

Introduction: Cognitive dissonance and selective exposure could explain how conspiracism could be adopted as a coping strategy in order to overcome salient threats. The expected psychopathological correlates could be investigated by empirical evidence.

Methods: A longitudinal observation of participants recruited from the Italian general population was performed. A total of 606 observations were collected. At T0, 336 individuals were recruited (from April to June 2020) and pseudo-anonymized, 270 retained at T1 (from October to December 2020). Subjects were evaluated by psychometric valid tools, such as Brief Symptoms Inventory (BSI), and Impact of Event Scale (IES). The variables of interest included age, gender, education, occupation, relationship status, life-time infection status, belief in conspiracy theories, adherence to lockdown measures, and vaccine hesitancy. Group differences at baseline were assessed by Mann-Whitney U test and Hedges' g for effect size. Differences in frequency for bivariate analysis was conducted by Fisher's exact test and Odds Ratios (OR) were also reported. Linear mixed models were used in order to estimate longitudinal trajectories.

Results: At baseline, individuals with a belief in conspiracy theories reported higher Somatization concerns in comparison to the rest of the sample (Hedges' g -0.424, p 0.023). In turn, those expressing vaccine hesitancy reported higher Obsession-Compulsion in comparison to the rest of the sample (g -0.341, p 0.025). Conspiracism was also associated with higher odds of having previously contracted COVID-19 (OR 1.96, p 0.013), vaccine hesitancy (OR 4.35, p <0.001), lower adherence to social

distancing behaviors (g -0.154, p 0.006), worry about the economic consequences of the pandemic (g -0.235, p 0.001). Longitudinal psychopathology was moderated both by vaccine hesitancy (for COVID-specific distress, minimum beta 0.303, maximum p 0.048), and conspiracism (Paranoid Ideation, beta 0.309, p 0.021).

Discussion: Belief in conspiracy theories was associated with individual, social, and psychological dimensions. In particular, with a previous infection by COVID-19 and a worry about economic consequences of social distancing measures. In turn, this belief was also associated with vaccine hesitancy.

Take-home message: Current results can improve public health policies in relation to vaccine hesitancy, in light of its interplay with cognitive dissonance, confirmation bias, selective exposure and threat salience.

INTRODUCTION

Since the early emergence of the COVID-19 pandemic, the lack of adherence to distancing measures has been a major obstacle to epidemic control of the infection. Reports highlighted the impact of conspiracy theories on the potential distrust towards regulatory guidelines [1], erosion in social distancing over time [2], and vaccine hesitancy [3]. Belief in conspiracy theories might thus hinder a wider adoption of scientifically motived behaviors, with an impact not solely on healthcare [4] but also on economics [5] and social trust [6]. More recently, science skepticism and attitudes towards the current scientific consensus were observed to moderate the compliance to shelter-in-place policies in the United States [7], suggesting that public health interventions might need to consider communication strategies to foster institutional trust and better design a long-term strategy for the containment of COVID-19.

Conspiracy theories can be defined as an effort to grasp the ultimate cause of an event, placing trust in a narrative that involves two or more powerful actors as scheming against the common good [8,9]. In the context of the COVID-19 pandemic, an overview of conspiracy themes investigated by psychology research has been recently described by van Mulukom and colleagues [10]. Theories tentatively explaining the pandemic entail: COVID-19 having an artificial origin, with an accidental or deliberate release, possibly as a bioweapon; the virus causing a mild condition exaggerated by the media, otherwise assimilable to flu; the pandemic being a medical conspiracy or hoax; the presence of a hidden cure, not disclosed to the general public; a proxy to introduce microchips via obligatory vaccination campaigns [10].

Of particular interest, a higher prevalence of vaccine hesitancy and belief in conspiracy theories has been described in the psychiatric setting [11,12], especially amongst people with personality disorders [13]. Contrasting results have been reported [14], the general press and common knowledge frequently associate both vaccine hesitancy and belief in conspiracy theories to the psychiatric domain, however, a definite and objective correlation has not yet been offered.

Nonetheless, mistrust in the medical or scientific community, lower preoccupation for the infection, and confidence in a narrative characterized by deception and scheming by a series of hidden actors can ultimately determine the adoption of a monological belief system [15], characterized by intuitive rather than rational thinking [16,17]. In other words, paranoid ideation may drive the adoption of conspiracism, which is in turn correlated with a broader system of beliefs.

Belief in conspiracy theories, in particular, was also previously found to be significantly associated with cognitive biases [18] - an evidence which has been described for COVID-19 as well [19–21]. These biases, mainly described to pertain conjunction violations, may inflate concurrent events as being causally linked. For COVID-19, conjunction violations may elevate the salience of side effects for treatments or vaccinations or misinterpret the severity of the infection at the population level.

In parallel, avoidance has been described as a potential maladaptive mechanism in order to cope with perceived salient threats, such as COVID-19 [22]. Similarly, conspiracism might represent one form of avoidance [23]. While minimization and avoidance have both been described as maladaptive in general, their relative efficacy in the short term may be beneficial [24], potentially explaining their retention at the population level at not-negligible levels of prevalence [25].

However, psychopathological features could signal distress even in light of avoidance, as in the case of somatization symptoms, where affective experience might be interpreted only somatically [26]. Concurrently, preliminary evidence showed a higher likelihood of adopting maladaptive coping strategies in presence of obsessive-compulsive symptoms [27], also interpretable in light of the correlation between obsession-compulsion and intolerance of uncertainty, reduced fear-extinction processes, hyper-responsiveness to threats [28-30].

In order to empirically test this hypothesis, i.e., conspiracism might be closely associated to other forms of intuitive thinking in light of perceived threats, the current study aimed at evaluating potential differences in vaccine hesitancy or social distancing as associated with the belief in conspiracy theories. Furthermore, in order to test the hypothesis that this monological sets of beliefs could influence psychopathological features in the long term, longitudinal trajectories of mental health correlates were explored as to what pertains moderation effects on a particular set of psychopathological domains (Somatization, Paranoid Ideation and Obsessive-Compulsive symptoms - as assessed with the Brief Symptoms Inventory, BSI; COVID-specific distress by the Impact of Event Scale -IES).

In summary, the results have confirmed an association between vaccine hesitancy and conspiracism. In concordance to cognitive dissonance theory, conspiracism was associated with the perceived threat of COVID-19 (economic consequences). Previous exposure to the infection was also correlated with conspiracism, which was interpreted considering survivorship and confirmation biases [9,10]. The study also found a higher likelihood of conspiracism in individuals with higher baseline levels of Somatization, in concordance to what would be expected by cognitive dissonance theory. Higher Obsessive-Compulsive symptoms were correlated with vaccine hesitancy. This evidence was discussed in light of feelings of uncertainty, selective exposure theory and conjunction fallacies.

Finally, it showed evidence of moderation for conspiracism and vaccine hesitancy on the longitudinal trajectories of psychopathological dimensions (Intrusive symptoms, Hyper-Arousal state and Paranoid Ideation), strengthening the hypothesis that coping strategies characterized by avoidance and conspiracism could be maladaptive in the long-term.

Aims

The primary aim of the study was to evaluate whether the belief in conspiracy theories was significantly associated with vaccine hesitancy, as well as a lower adherence to social distancing behaviors. The secondary aim of the study was to evaluate the longitudinal assessment of Somatization, Obsessive-Compulsive symptoms, and Paranoid Ideation, in light of the belief in conspiracy theories and vaccine hesitancy.

METHODS

Study design

This observational, longitudinal study involved subjects recruited in the Italian general population. The baseline evaluation (T0) was carried out between April and June 2020, after the Italy set a generalized lockdown in place on the national territory. The follow-up evaluation (T1) was assessed between October and December 2020, after prolonged conditions of lockdown, insecurity

and during the persistence of the COVID-19 pandemic. Sociodemographic data were collected at each time-point (age, gender, occupation, educational level). The questionnaires administered did not have an option to opt out from specific questions or parts of the survey. All questions had to be filled in before submitting the results. All observations were pseudo-anonymized, and a personal identifier used in order to match data points longitudinally.

Participants and instruments

The sample was composed by a group of healthy men and women undergoing an assessment of general psychopathology as part of a control group for case-control studies. All participants were asked to provide their consent for their participation. All individuals were recruited using convenience and snowball sampling methods, with the following inclusion criteria: age between 18 and 60 years old, and Italian nationality. Exclusion criteria included illiteracy or inability to provide consent or to complete the survey online, not having completed a full evaluation at T0 (for T1). Illiteracy was determined as the inability to provide written consent, or not being able to comprehend the written information presented in the informed consent form.

Both evaluations were administered during the COVID-19 pandemic periods s (T0 and T1): general psychopathology was assessed through the Brief Symptoms Inventory [31]; traumatic symptoms related to COVID-19 were measured through a specifically adapted version of the Impact of Event Scale Questionnaire – Revised [32-35]. BSI is a self-reported 53-items questionnaire aimed at quantifying general psychopathological symptoms in adults over the previous week. IES is a 22-items questionnaire that assesses subjective distress secondary to traumatic events [36]. It evaluates symptomatology over the previous week, and it is directed to a sample of adults. It is composed of a total score (Cronbach's alpha 0.95) and three subscales, namely: Intrusion (Cronbach's alpha 0.92), Avoidance (Cronbach's alpha 0.85) and Hyperarousal (Cronbach's alpha 0.9).

In order to evaluate the attitudes towards SARS-CoV-2 vaccines (potentials, or already marketed), participants were asked to indicate whether they would vaccinate themselves or not (single item). Other two questions were offered about attitudes towards vaccination, specifically whether they deemed vaccinations to be held as obligatory, and whether they would prefer to have relatives vaccinated (answers accepted: Yes or No). A single yes-or-no question asked whether the participant ever personally contracted COVID-19 infection. Moreover, single questions on a 4-point Likert scale were offered: whether the participants feared the infection for themselves or their relatives, whether the participants feared the economic consequences of the COVID-19 pandemics at the present time. Further questions were offered through a 4-points Likert scale: whether the participants observed lockdown policies at baseline, whether the participants felt their observance will decline in the future. The ad-hoc questionnaire can be found in the Supplementary Materials as Table S1a and Table S1b.

As no validated questionnaire existed at time of survey administration, an ad-hoc set of questions investigating the belief in conspiracy theories on COVID-19 was presented to participants at T1, through a 5-point Likert Scale and 18 items. The Italian and English-translated versions of the questionnaire can be found in the Supplementary Materials as Table S2a and Table S2b. The conspiracy themes investigated were: COVID-19 being of artificial origin; the virus causing only a mild condition, with symptoms and consequences exaggerated by the media; a hidden cure being available, but not disclosed; vaccination or screening campaigns as a proxy to introduce microchips in the general population; 5G technology playing a role in COVID-19; governments or hidden players deliberately spreading the virus, possibly as a means of mass population control.

Data analysis

Sample descriptive were offered with mean values (for continuous variables) and proportions (for categorical) by timepoint. In order to evaluate the role of conspiracy theories, participants were assigned to two categories depending on their answers to the Conspiracy Questionnaire. If a participant answered "Completely Agree" to at least one conspiracy, it was assigned to the "Conspiracy Theories – Complete Belief" category. Similarly, if a participant answered "Partially Agree" to at least one conspiracy, it was assigned to the "Conspiracy Theories – Partial Belief"

category. A descriptive account of the sample, by approval of conspiracy theories, can be found in the Supplementary Materials as Table S3.

Differences for what concerns psychometric domains, and time differences between baseline and follow-up were offered by paired sample differences (Wilcoxon signed-rank). Mann-Whitney U tests and estimates of effect sizes – in Hedges' g scores - were calculated to estimate group differences between two independent samples, in order to compare those satisfying the "Conspiracy Theories Belief" definitions above in regard to the observance of social distancing, prevention rules, potential worries and personal COVID-19 infections correlated to the pandemics. Decay in the adherence to lockdown measures was calculated comparing the answers to Question 1 and Question 2 in Table 3a.

A contingency table was constructed, comparing adherence to lockdown at present and future times. Odds ratios and exact Fisher tests were measured. The Odds Ratio and exact Fisher test p-values of opposing personal vaccination, opposing vaccination for relatives, opposing obligatory vaccination for the general population, having personally contracted COVID-19 were also explored. Linear regressions were estimated with the sum of each question by Likert scale to the Conspiracy Questionnaire, with education (years of schooling), sex, being a healthcare worker, having a partner and region of residence as predictors.

In order to evaluate the longitudinal impact of COVID-19, a repeated measure approach was adopted for secondary analyses, through Linear Mixed Models with random intercepts for each participant and Time as a fixed effect. Further modeling was carried forward, using Linear Mixed Models with random intercepts for each participant and "Time", "Moderator" and "Time*Moderator" as fixed effects. Statistical significance was defined at p value below 0.05. R version 4.1.1 [37] was used for the statistical analyses and plotting, in addition of the following libraries: *tidyverse* [38], *nlme* [39], *sciplot* [40].

Ethical aspects

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. This study was approved by the local Ethics Committee. The protocol was first approved on the 8th of October 2019, as part of a general assessment of psychopathology in a control group (registration number CEAVC 14,655). Later amendments, due to the insurgence of the COVID-19 pandemic, were approved on the 14th of April of 2020 (registration number CEAVC 17063). All participants have given informed consent for participation in the research study.

RESULTS

A total of 606 observations were collected. At T0, 336 participants were recruited and 270 retained at T1 (80% of the initial sample). The majority of the sample, at each time point, was female and was representative of a well-educated population (~50% with a college degree at any time point). Healthcare workers composed 20% of the sample at T0; 22% at T1. Thirty out of 38 participants with complete belief in at least one conspiracy theory had personally contracted COVID-19. Most of the sample, at time of enrollment, was residing in Tuscany (224, 66.67%), or Lazio (63, 18.75%), both in Central Italy (overall: 287, 85.42%). Thirty individuals resided in North Italy (Lombardy, Friuli-Venezia-Giulia or Piemonte: 8.93%) and 19 in the South (Calabria 10, Puglia 9, 5.65%). An overview of the sample, divided by time-point of evaluation, was offered in Table 1.

Table 1. Sample descriptive.

	T0	T1
N	336	270
Age (years)	30.66 (±14.07)	29.96 (±12.17)
Gender	154 M (45.83%)	112 M (41.48%)

	182 F (54.17%)	158 F (58.52%)	
Graduates	200 (59.5%)	146 (54.07%)	
Having a partner	237 (70.5%)	191 (70.74%)	
Healthcare workers	68 (20.23%)	59 (21.85%)	
Personally, contracted COVID-19 infection	/	145 (53.70%)	
Partially agreed to at least one Conspiracy Belief §	/	88 (32.59%)	
Completely agreed to at least one Conspiracy Belief §	/	38 (14.07%)	
Would not personally vaccinate themselves §	/	63 (23.33%)	
Would not wish for relatives to be vaccinated §	/	43 (15.92%)	
Would not wish for obligatory vaccination §	/	62 (22.96%)	
BSI Depression	0.97 (±0.94)	1.13 (±1.15)	**
BSI Anxiety	0.82 (±0.87)	0.99 (±1.07)	
BSI Somatization	0.43 (±0.70)	0.59 (±0.87)	
BSI Obsession-Compulsion	0.82 (±0.94)	0.90 (±1.06)	**
BSI Hostility	0.56 (±0.73)	0.90 (±1.16)	
BSI Interpersonal Sensitivity	0.59 (±0.88)	0.90 (±1.16)	
BSI Phobic Anxiety	0.58 (±0.78)	0.81 (±0.93)	
BSI Psychoticism	0.55 (±0.69)	0.71 (±0.91)	
BSI Paranoid Ideation	0.53 (±0.80)	0.72 (±0.97)	
BSI Global Severity Index	0.56 (±0.68)	0.83 (±0.89)	*
IES Avoidance	0.81 (±0.69)	0.90 (±0.77)	
IES Intrusion	0.78 (±0.68)	0.96 (±0.91)	
IES Hyperarousal	1.00 (±0.79)	1.12 (±1.01)	
IES Total Score	18.73 (±14.18)	21.67 (±18.30)	

Note: Percentages in comparison to total sample.

* p <0.05 ** p <0.01 *** p < 0.001 § As evaluated by ad-hoc questionnaire in Supplementary

Materials ± = Standard Deviation M = Males F =Females

The most common conspiracy theories in the sample were: COVID-19 being intentionally created as a biological weapon (41 participants, 15% of the sample); COVID-19 having originated from a laboratory (79 participants, 28% of the sample). For what concerns prevention measures, 14 participants partially agreed, 8 participants completely agreed (22 participants in total, 8% of the sample) to the belief that those measures were detrimental for the control of COVID-19. A detailed account of the sample, by belief in conspiracy theories, can be found in the Supplementary Materials as Table S2.

Individuals partially agreeing to conspiracy theories showed higher BSI Somatization scores at baseline in comparison to the rest of the sample (Hedges' g = -0.424, p-value = 0.023). Participants indicating hesitancy towards vaccination for relatives were observed to have higher BSI Obsession-Compulsion scores at baseline in comparison to the rest of the sample (g = -0.341, p-value = 0.025). Results were reported in Table 2.

Table 2. Group differences at baseline, belief in conspiracy theories and vaccine hesitancy.

	Conspiracy Theories		Vaccine Hesitancy		
	Partial Belief	Complete Belief	Personal vaccination	Vaccination for relatives	Obligatory vaccination
BSI Somatization	g -0.424 * (p 0.023)	g -0.351 (p 0.131)	g 0.010 (p 0.641)	g -0.190 (p 0.455)	g 0.180 (p 0.357)
BSI Obsession-Compulsion	g -0.037 (p 0.777)	g 0.040 (p 0.869)	g -0.179 (p 0.089)	g -0.341 * (p 0.025)	g 0.164 (p 0.914)
BSI Paranoid Ideation	g -0.276 (p 0.628)	g -0.098 (p 0.972)	g 0.174 (p 0.477)	g -0.032 (p 0.978)	g 0.472 (p 0.055)
IES Avoidance	g -0.271 (p 0.175)	g -0.151 (p 0.437)	g 0.069 (p 0.867)	g 0.033 (p 0.919)	g 0.363 (p 0.167)
IES Intrusion	g -0.314 (p 0.141)	g -0.219 (p 0.433)	g 0.201 (p 0.399)	g 0.195 (p 0.641)	g 0.260 (p 0.382)
IES Hyperarousal	g -0.241 (p 0.364)	g -0.080 (p 0.782)	g 0.087 (p 0.845)	g 0.052 (p 0.964)	g 0.288 (p 0.436)
IES Total Score	g -0.302 (p 0.181)	g -0.169 (p 0.481)	g 0.133 (p 0.716)	g 0.105 (p 0.948)	g 0.338 (p 0.259)

Note: Significant difference in mean values, comparison to rest of the sample. Hedges' g reported for effect size (negative values indicate higher scores among the evaluated category). p = p-value at Mann-Whitney t-test   g = Hedges' g effect size.

Belief in conspiracy theories was significantly associated with education (t-statistics = -2.872, p-value = 0.005), but not age (t-statistics = 0.423, p-value = 0.673), sex (t-statistics = -0.028, p-value = 0.978), having a partner (t-statistics = 0.737, p-value = 0.462), being a health-care worker (t-statistics = -1.122, p-value = 0.264), or region of residence (t-statistics = -1.245, p-value = 0.217).

Cross-sectional results– social distancing and vaccine hesitancy

No difference was found between individuals indicating a belief in conspiracy theories in comparison to the rest of the sample for what concerns social distancing behaviors at the time of enrolment. Nonetheless, participants agreeing to conspiracy theories indicated a lower prospect of adherence to the same measures in the future (partial belief – g = 0.154, p-value = 0.006; complete belief - g = 0.158, p-value = 0.036). Further details, including statistical significance and estimates of effect size can be found in the text as Table 3a.

Moreover, belief in at least one conspiracy theory was significantly associated with higher likelihoods of vaccine hesitancy, both in terms of personal vaccination (partial belief – Odds Ratio = 4.35, p <0.001; complete belief – OR = 4.88, p <0.001) and of attitudes for a potential vaccination for relatives (partial belief – OR = 5.19, p <0.001; complete belief – OR = 4.08, p <0.001). Similarly, belief in at least one conspiracy theory was significantly associated with a negative stance towards

obligatory vaccination campaigns (partial belief – OR = 4.15, p <0.001; complete belief – OR = 3.82, p <0.001). Finally, belief in at least one conspiracy theory was significantly associated with higher likelihoods of previous COVID-19 infection (partial belief – OR = 1.96, p <0.001; complete belief – OR = 3.82, p <0.001). Results were described in Table 3b.

Table 3a. Conspiracy theories and social attitudes.

	Conspiracy Theories Partial Belief	Conspiracy Theories Complete Belief
Adherence to social distancing measures (at the present time)	g 0.073 (p 0.138)	g 0.087 (p 0.412)
Adherence to social distancing measures (in the future)	g 0.154 * (p 0.006)	g 0.158 * (p 0.036)
Scared of personal COVID-19 infection	g -0.067 (p 0.348)	g -0.150 (p 0.119)
Scared of COVID-19 infection for their relatives	g 0.137 (p 0.028)	g 0.119 (p 0.157)
Scared of the economic consequences of COVID-19	g -0.235 * (p 0.001)	g -0.276 * (p 0.005)

Note: Significant mean difference in comparison to general population and visually marked with an asterisk p = p-value at Mann-Whitney t-test g = Hedges' g effect size

Table 3b. Conspiracy theories and vaccine hesitancy.

	Conspiracy Theories – Partial Belief	Conspiracy Theories – Complete Belief
Personal vaccination	OR 4.35 * (p-value <0.001)	OR 4.88 * (p-value <0.001)
Vaccination for relatives	OR 5.19 * (p-value <0.001)	OR 4.08 * (p-value <0.001)
Obligatory vaccination	OR 4.15 * (p-value <0.001)	OR 4.36 * (p-value <0.001)
Contracted COVID-19 infection	OR 1.96 * (p-value 0.013)	OR 3.82 * (p-value <0.001)

Note: p-value at the Exact Fisher Test. Higher odds ratio indicate higher probability of indicating a future decay in social distancing adherence, having contracted COVID-19, refusing personal vaccination, obligatory vaccination, or vaccination for relatives.

Longitudinal assessment

An effect for time between the two evaluations, irrespective of belief in conspiracy theories or vaccine hesitancy was found for COVID-specific distress (Intrusion, beta = 0.102, p-value = 0.032). Attitudes towards vaccination for relatives (beta = 0.379, p-value = 0.023) and towards obligatory vaccination campaigns (beta 0.303, p-value = 0.048) moderated the Hyper-Arousal domain of IES. Similarly, attitudes towards vaccination for relatives also moderated the Intrusion domain (beta = 0.372, p-value = 0.027) and the Total score of IES (beta = 6.660, p-value = 0.031). Complete belief in at least one conspiracy theory moderated the Paranoid Ideation domain of BSI (beta = 0.309, p-value = 0.021). Results were reported in Table 4.

Table 4. Longitudinal analyses, psychopathology (*n* = 270).

	Estimate Intercept	Estimate T1 (Prolonged Pandemics)	p-value T1
IES Avoidance	0.922	-0.004	0.911
	(±0.028)	(±0.044)	
IES Intrusion	0.871	0.102	0.032*
	(±0.030)	(±0.047)	
IES Hyper-arousal	1.074	0.036	0.478
	(±0.034)	(±0.050)	
IES Total Scale	20.691	1.065	0.242
	(±0.611)	(±0.908)	
BSI Somatization	0.542	0.032	0.396
	(±0.029)	(±0.004)	
BSI Obsession-Compulsion	0.965	-0.059	0.232
	(±0.037)	(±0.049)	
BSI Paranoid Ideation	0.612	0.047	0.257
	(±0.032)	(±0.041)	

Note: IES = Impact Event Scale   BSI = Brief Symptom Inventory   ± Standard Error

DISCUSSION

Both general psychopathology and distress as a response to COVID-19 were observed to significantly worsen across 2020 among those individuals with partial or complete belief in conspiracy theories, as well as among those expressing vaccine hesitancy. While the previous literature on the topic highlighted a role for conspiracy theories and vaccine hesitancy as predictors of general psychopathology [41], most results concerned cross-sectional surveys. The current study thus offers valuable evidence, showing that both vaccine hesitancy and conspiracy theories had a moderating role on the longitudinal trajectories for these individuals.

Significant differences at baseline were observed among participants with partial belief in conspiracy theories (higher Somatization), and among participants skeptical of vaccination for their relatives (higher Obsession-Compulsion), in comparison to controls. Moreover, the belief in conspiracy theories was also associated with higher odds of having personally contracted COVID-19, vaccine hesitancy, lower adherence to social distancing behaviors, worry about the economic consequences of the pandemic. Finally, 79% participants indicating a complete belief in at least one conspiracy theory had previously contracted COVID-19. Therefore, previous evidence on an interplay between the perceived threat of the infection and the belief in conspiracy theories seems corroborated [42].

Is then the belief in conspiracy theories more commonly found among individuals with a higher psychopathology? The current study indicates that a higher somatic preoccupation (BSI Somatization) may be found in those individuals expressing a belief in a conspiracy theory on COVID-19. Concurrently, higher obsession-compulsion (BSI Obsession-Compulsion) was found in those individuals expressing hesitancy for the vaccination of relatives. Therefore, rather than a general elevation in psychopathological dimensions, or a form of psychoticism, this belief might be interpreted as a tentative defense strategy to cope with the perceived threat of the virus on the physical health, or of the perceived threat of potential side-effects for the vaccination itself, as per previous experimental evidence [43].

Healthcare workers, while being exposed to significant mental distress during the COVID-19 pandemic [44–50], did not represent a higher likelihood to believe in conspiracy theories related to the virus, thus potentially exhibiting diverging coping strategies and a lower predisposition to engage in cognitive dissonance as a psychological defense mechanism. Education, on the other hand,

did have a significant and negative association with conspiracy theories, a result that can be interpreted both as a function of coping strategies (more effective defense mechanisms as correlated to higher education), but also in light of a more accurate cognitive appraisal of information for what concerns the orientation towards the information space [51–53].

Conspiracy theories and vaccine hesitancy

Vaccine hesitancy is one of the most important barriers to a full control of COVID-19 [6,54–55]. Current results confirm the role of conspiracy beliefs as being associated with vaccine hesitancy, and thus as representing a barrier for the effective control of COVID-19 [2,56–59]. The current study found a higher likelihood for vaccine hesitancy among those indicating a belief in conspiracy theories on COVID-19, which is supported by the previous evidence on the topic [3,60]. Furthermore, previous literature highlighted a focus on the importance of institutional communications in promoting social distancing behaviors or vaccination campaigns [61–63], but these efforts have mainly focused on the personal consequences of viral infections (as in, personal risks rather than risks for relatives, partners or friends). In the current study vaccine hesitancy was more prevalent when considering personal vaccination rather than vaccination for relatives, supporting the notion that an effective communication strategy might be to vehiculate the importance of self-vaccination in light of the perceived severity of infection among older family members and those with pre-existing health conditions [17,61].

Finally, current findings supported an extension of the current framework of interpretation for the impact of scientific skepticism as an obstacle to an optimized public health response to COVID-19 [64–66], in fact those agreeing to conspiracy theories were more likely to predict a lower adherence to social distancing behaviors in the future, as well as a lower propensity to vaccination (in a gradual relationship, with lower odds ratios in those partially agreeing and higher odds ratio in those completely agreeing). This finding is of critical interest, as vaccination campaigns might still interest public health policies [67,68], with the adoption of yearly or repeated doses as a response to viral mutation and to the emergence of variants [69,70].

Conspiracism and cognitive dissonance

Conspiracism itself seems driven by a cognitive bias towards the underestimation of severe consequences following COVID-19 infection – or generally any salient threat, through an avoidant mechanism of perceived hazard. A special case of this cognitive style, namely survivorship or confirmation bias, inflates the individual experience of a mild illness for an indication of general safety for the virus, promoting mistrust towards scientific or institutional communications. Once established, such epistemic belief of suspect promotes selective exposure to (mis)information, which in turn feeds again the belief in conspiracy theories and scientific skepticism. In fact, conspiracy theories were found to be mainly interrelated, even when contradictory in nature [15], effectively representing a style of reasoning not motivated by analytic considerations [17], but rather by denialism and selective exposure to validating information, tentatively seeking to re-establish personal agency in response to uncertainty and feelings of powerlessness [9,71,72]. For instance, subjective perception of a loss of control during COVID-19 predicted the level of endorsement for conspiracy theories [73]. In current results, economic worry was also significantly associated with conspiracy beliefs, while previous evidence described an interplay between financial preoccupations and vaccine hesitancy during COVID-19 [74].

Similar to the sunk cost fallacy (a general tendency can be here described to over-estimate the incurred costs of a given choice, in favor of global conservation of personal convictions and policies), individuals therefore require progressively more and stronger proofs of confutation in order to revisit their attitudes towards an intervention (i.e., vaccination campaigns) or their narratives over a given event (i.e., COVID-19 potentially causing a severe disease). This selective exposure – characterized both by a selective favoring of particular stimuli (informational or relational), reinforcing previous stances, and by a selective avoidance of contradictory information – facilitates the adoption of conspiracy theories. Selective exposure, in turn, may also represent a maladaptive coping

mechanism, partially effective in the short term, but ultimately maladaptive when discrepant information is encountered and cannot be disproved, challenged, minimized or distorted [71,75,76].

In conclusion, in current results conspiracism longitudinally moderated Paranoid Ideation, while the impact of COVID (as assessed both by Intrusive and Hyper-Arousal symptoms) was moderated by the attitudes towards vaccination. This evidence could be interpreted in light of a heighted preoccupation for health safety, conflating the risk of exposure to COVID-19 also with the risk of experiencing side-effects by vaccinations.

Study limitations

T1 was collected after the summer of 2020, when the extent of the restrictions in Italy was minimal, and before the second and third wave of infections and subsequent lockdowns in the country. Adherence to lockdown measures was measured subjectively, and the decline in adherence to future policies among conspiracy believers might indicate a lower resistance in disclosing information that does not entail past law-breaking behaviors. In fact, although the survey was anonymous, participants could be under the influence of not disclosing potentially self-incriminating behaviors.

CONCLUSION

Conspiracy theories were significantly associated with a higher impact of COVID-19 on mental health, as evaluated by both BSI and IES. Conspiracy theories were also associated with a lower adoption of social distancing behaviors and with a higher likelihood of indicating vaccine hesitancy. Current results were reviewed in light of previous literature on cognitive biases, cognitive dissonance, selective exposure, and threat salience [77,78].

In summary, selective exposure to (mis)information may represent a maladaptive coping mechanism, promoting a monological set of personal convictions primarily motivated by emotional rather than analytic thinking. Communication strategies aimed at promoting social distancing behaviors or vaccine campaigns should then focus on one hand on the societal/relational dangers of contagion – rather than personal – and on the other hand on the emotional/experiential content of danger rather than analytic reasoning.

Supplementary Materials

Table S1a – Ad-hoc questionnaire, Original Version in Italian				
Di seguito trova una lista di alcune delle teorie riguardanti l'origine e/o la diffusione del COVID-19 che sono circolate recentemente. Indichi quanto si trova in accordo o in disaccordo con ognuna di esse				
Domanda				
È mai risultato positivo ad un test diagnostico per COVID-19?	Sono risultato positivo		Non sono mai risultato positivo	
Se venisse prodotto un vaccino per il COVID-19 lo farebbe?	Sì		No	
Se venisse prodotto un vaccino per il COVID-19 vorrebbe che i suoi cari lo facessero?	Sì		No	
Se venisse prodotto un vaccino per il COVID-19 vorrebbe che fosse reso obbligatorio su larga scala?	Sì		No	
Riguardo alla nuova ondata di contagi di COVID-19, quanto ha paura del contagio per sé stesso?	0 Per Nulla	1 Poco	2 Abbastanza	3 Molto
Riguardo alla nuova ondata di contagi di COVID-19, quanto ha paura del contagio per i suoi cari?	0 Per Nulla	1 Poco	2 Abbastanza	3 Molto
Riguardo alla nuova ondata di contagi di COVID-19, quanto ha paura del danno economico per sé stesso?	0 Per Nulla	1 Poco	2 Abbastanza	3 Molto
Quanto sta aderendo alle attuali misure obbligatorie per il COVID-19?	0 Per Nulla	1 Poco	2 Abbastanza	3 Molto
Quanto pensa che aderirà ad eventuali misure che potrebbero essere messe in atto nei prossimi mesi per il COVID-19?	0 Per Nulla	1 Poco	2 Abbastanza	3 Molto

Table S1b – Ad-hoc questionnaire, Translated Version in English
You will find a list of theories regarding the origin and/or the diffusion of COVID-19 that recently gathered attention. Please indicate how much you agree/disagree with any of these:
Question

Have you ever been tested positive to COVID-19 before?		I have previously been tested positive		I have never been tested positive before
If a vaccine for COVID-19 would be produced, would you vaccinate yourself?		Yes		No
If a vaccine for COVID-19 would be produced, would you wish for your relatives to be vaccinated?		Yes		No
If a vaccine for COVID-19 would be produced, would you wish for the vaccine to be obligatory for the general population?		Yes		No
Regarding the recent increase in COVID-19 cases, how worried of personal infection would you describe yourself to be?	0 At all	1 Slightly worried	2 Moderately worried	3 Severely worried
Regarding the recent increase in COVID-19 cases, how worried of infection for relatives would you describe yourself to be?	0 At all	1 Slightly worried	2 Moderately worried	3 Severely worried
Regarding the recent increase in COVID-19 cases, how worried of personal economic loss would you describe yourself to be?	0 At all	1 Slightly worried	2 Moderately worried	3 Severely worried
Are you currently adhering to general obligatory safety measures for COVID-19?	0 At all	1 Minor adhering	2 Moderately adhering	3 Completely adhering
How likely would you be to adhering to eventual general obligatory safety measures for COVID-19 in the future?	0 At all	1 Minor adhering	2 Moderately adhering	3 Completely adhering

Table S2a – Conspiracy Theories Questionnaire, Original Version in Italian

Di seguito trova una lista di alcune delle teorie riguardanti l'origine e/o la diffusione del COVID-19 che sono circolate recentemente. Indichi quanto si trova in accordo o in disaccordo con ognuna di esse

Domanda

1. Il coronavirus è un'arma biologica creata intenzionalmente	-2 Completamente in Disaccordo	-1 Parzialmente in Disaccordo	0 Non So/Neutro	1 Parzialmente in Accordo	2 Completamente in Accordo
2. Il coronavirus era contenuto in un laboratorio da cui è sfuggito	-2 Completamente in Disaccordo	-1 Parzialmente in Disaccordo	0 Non So/Neutro	1 Parzialmente in Accordo	2 Completamente in Accordo

	-2	-1	0 Non	1	2
3. L'origine del coronavirus è la conseguenza di un uso eccessivo dei vaccini	-2 Completamente in Disaccordo	-1 Parzialmente in Disaccordo	0 Non So/Neutro	1 Parzialmente in Accordo	2 Completamente in Accordo
4. Il virus è stato diffuso volontariamente da uno o più governi per ottenere vantaggi politici e/o economici	-2 Completamente in Disaccordo	-1 Parzialmente in Disaccordo	0 Non So/Neutro	1 Parzialmente in Accordo	2 Completamente in Accordo
5. Il coronavirus è trasmesso e/o diffuso dalle antenne 5G	-2 Completamente in Disaccordo	-1 Parzialmente in Disaccordo	0 Non So/Neutro	1 Parzialmente in Accordo	2 Completamente in Accordo
6. La tecnologia 5G rende vulnerabili al coronavirus	-2 Completamente in Disaccordo	-1 Parzialmente in Disaccordo	0 Non So/Neutro	1 Parzialmente in Accordo	2 Completamente in Accordo
7. Il coronavirus non esiste, gli eventuali sintomi sono dovuti ad altre malattie	-2 Completamente in Disaccordo	-1 Parzialmente in Disaccordo	0 Non So/Neutro	1 Parzialmente in Accordo	2 Completamente in Accordo
8. La cura del coronavirus esiste già ma i poteri forti ne impediscono la diffusione	-2 Completamente in Disaccordo	-1 Parzialmente in Disaccordo	0 Non So/Neutro	1 Parzialmente in Accordo	2 Completamente in Accordo
9. Le misure di prevenzione (ad esempio le mascherine ed il gel per le mani) servono in realtà a impedire lo sviluppo di una immunità naturale al virus	-2 Completamente in Disaccordo	-1 Parzialmente in Disaccordo	0 Non So/Neutro	1 Parzialmente in Accordo	2 Completamente in Accordo
10. La malattia da coronavirus non è così grave come vogliono farci credere	-2 Completamente in Disaccordo	-1 Parzialmente in Disaccordo	0 Non So/Neutro	1 Parzialmente in Accordo	2 Completamente in Accordo
11. Il coronavirus è stato diffuso intenzionalmente come misura per ridurre la numerosità della popolazione mondiale	-2 Completamente in Disaccordo	-1 Parzialmente in Disaccordo	0 Non So/Neutro	1 Parzialmente in Accordo	2 Completamente in Accordo
12. Il coronavirus è stato diffuso intenzionalmente come misura di controllo sociale	-2 Completamente in Disaccordo	-1 Parzialmente in Disaccordo	0 Non So/Neutro	1 Parzialmente in Accordo	2 Completamente in Accordo
13. Bill Gates ha avuto un ruolo nella creazione e/o ha facilitato la diffusione del coronavirus	-2 Completamente in Disaccordo	-1 Parzialmente in Disaccordo	0 Non So/Neutro	1 Parzialmente in Accordo	2 Completamente in Accordo
14. Il coronavirus è stato diffuso intenzionalmente come parte di un progetto più ampio	-2 Completamente in Disaccordo	-1 Parzialmente in Disaccordo	0 Non So/Neutro	1 Parzialmente in Accordo	2 Completamente in Accordo
15. Il coronavirus non è più grave di una banale influenza, le misure adottate sono francamente eccessive	-2 Completamente in Disaccordo	-1 Parzialmente in Disaccordo	0 Non So/Neutro	1 Parzialmente in Accordo	2 Completamente in Accordo
16. I governi e/o i poteri forti sfruttano la storia del coronavirus come misura di controllo sociale	-2 Completamente in Disaccordo	-1 Parzialmente in Disaccordo	0 Non So/Neutro	1 Parzialmente in Accordo	2 Completamente in Accordo
17. I governi e/o i poteri forti sfruttano la storia del coronavirus per ricavarne dei benefici economici	-2 Completamente in Disaccordo	-1 Parzialmente in Disaccordo	0 Non So/Neutro	1 Parzialmente in Accordo	2 Completamente in Accordo
18. In occasione del tampone viene inserito un microchip nelle persone	-2 Completamente in Disaccordo	-1 Parzialmente	0 Non So/Neutro	1 Parzialmente in Accordo	2 Completamente in Accordo

	in Disaccordo				
Table S2b – Conspiracy Theories Questionnaire, Translated Version in English					

You will find a list of theories regarding the origin and/or the diffusion of COVID-19 that recently gathered attention. Please indicate how much you agree/disagree with any of these:

Question

1. Coronavirus is a biological weapon created intentionally	-2 Completely Disagree	-1 Partially Disagree	0 Do Not Know/Neutral	1 Partially Agree	2 Completely Agree
2. Coronavirus was held in a laboratory, and subsequently escaped	-2 Completely Disagree	-1 Partially Disagree	0 Do Not Know/Neutral	1 Partially Agree	2 Completely Agree
3. The origin of the coronavirus is the consequence of an excessive use of vaccinations	-2 Completely Disagree	-1 Partially Disagree	0 Do Not Know/Neutral	1 Partially Agree	2 Completely Agree
4. The virus was spread voluntarily in order to obtain political and/or economic benefits	-2 Completely Disagree	-1 Partially Disagree	0 Do Not Know/Neutral	1 Partially Agree	2 Completely Agree
5. Coronavirus is transmitted/spread by 5G antennae	-2 Completely Disagree	-1 Partially Disagree	0 Do Not Know/Neutral	1 Partially Agree	2 Completely Agree
6. 5G technology makes us vulnerable to the coronavirus	-2 Completely Disagree	-1 Partially Disagree	0 Do Not Know/Neutral	1 Partially Agree	2 Completely Agree
7. Coronavirus does not exist, and eventual symptoms are due to other diseases	-2 Completely Disagree	-1 Partially Disagree	0 Do Not Know/Neutral	1 Partially Agree	2 Completely Agree
8. The cure for the coronavirus exists, but strong powers impede its diffusion	-2 Completely Disagree	-1 Partially Disagree	0 Do Not Know/Neutral	1 Partially Agree	2 Completely Agree
9. Prevention measures (such as wearing masks, disinfecting gel for hands) actually hinder the development of a natural immunity to the virus	-2 Completely Disagree	-1 Partially Disagree	0 Do Not Know/Neutral	1 Partially Agree	2 Completely Agree
10. The coronavirus disease is not as severe as they would like us to believe	-2 Completely Disagree	-1 Partially Disagree	0 Do Not Know/Neutral	1 Partially Agree	2 Completely Agree
11. Coronavirus was intentionally spread in order to reduce the world's population	-2 Completely Disagree	-1 Partially Disagree	0 Do Not Know/Neutral	1 Partially Agree	2 Completely Agree
12. Coronavirus was intentionally spread as a measure of social control	-2 Completely Disagree	-1 Partially Disagree	0 Do Not Know/Neutral	1 Partially Agree	2 Completely Agree
13. Bill Gates had a role in the creation of the coronavirus and/or facilitated its diffusion	-2 Completely Disagree	-1 Partially Disagree	0 Do Not Know/Neutral	1 Partially Agree	2 Completely Agree
14. Coronavirus was intentionally spread as part of a larger scheme	-2 Completely Disagree	-1 Partially Disagree	0 Do Not Know/Neutral	1 Partially Agree	2 Completely Agree
15. Coronavirus is not more severe than a common cold, and the adopted measures are excessive	-2 Completely Disagree	-1 Partially Disagree	0 Do Not Know/Neutral	1 Partially Agree	2 Completely Agree
16. Governments and/or strong powers take advantage of coronavirus as a measure of social control	-2 Completely Disagree	-1 Partially Disagree	0 Do Not Know/Neutral	1 Partially Agree	2 Completely Agree
17. Governments and/or strong powers take advantage of coronavirus in order to gain economic benefits	-2 Completely Disagree	-1 Partially Disagree	0 Do Not Know/Neutral	1 Partially Agree	2 Completely Agree
18. When a diagnostic swap is performed, a microchip is inserted into people	-2 Completely Disagree	-1 Partially Disagree	0 Do Not Know/Neutral	1 Partially Agree	2 Completely Agree

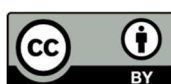| Table S3 – Conspiracy Theories, Descriptive Statistics of the Sample, descending order						
	Partially Agree (N)	Completely Agree (N)	Partially Agree Ranking	Completely Agree Ranking	Partially Agree Percent	Completely Agree Percent
Conspiracy 2	57	22	1	1	21%	8%
Conspiracy 1	28	13	4	2	10%	5%
Conspiracy 4	23	9	5	3	9%	3%
Conspiracy 14	14	9	9	3	5%	3%
Conspiracy 9	14	8	9	5	5%	3%
Conspiracy 17	30	7	2	6	11%	3%
Conspiracy 8	14	6	9	7	5%	2%
Conspiracy 16	30	6	2	7	11%	2%
Conspiracy 11	15	5	7	9	6%	2%
Conspiracy 12	18	5	6	9	7%	2%
Conspiracy 10	15	4	7	11	6%	1%
Conspiracy 18	4	3	14	12	1%	1%
Conspiracy 3	6	2	13	13	2%	1%
Conspiracy 13	2	2	16	13	1%	1%
Conspiracy 15	12	2	12	13	4%	1%
Conspiracy 5	1	1	17	16	0%	0%
Conspiracy 6	1	1	17	16	0%	0%
Conspiracy 7	4	1	14	16	1%	0%
Note: descending order by Completely Agree Rankings						

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