Compliance with containment measures to the COVID-19 pandemic over time: Do antisocial traits matter?

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ABSTRACT

This study investigated the relationships between antisocial traits and compliance with COVID-19 containment measures. The sample consisted of 1578 Brazilian adults aged 18–73 years who answered facets from the PID-5, the Affective resonance factor of the ACME, and a questionnaire about compliance with containment measures. Latent profile analyses indicated a 2-profile solution: the antisocial pattern profile which presented higher scores in Callousness, Deceitfulness, Hostility, Impulsivity, Irresponsibility, Manipulativeness, and Risk-taking, as well as lower scores in Affective resonance; and the empathy pattern profile which presented higher scores in Affective resonance and lower scores in ASPD typical traits. The latent profile groups showed significant differences between them and interaction with the containment measures and weeks. The antisocial and empathy groups showed significant differences. These differences were sustained in the interaction with the containment measures and weeks separately, but not when all were interacting together. Our findings indicated that antisocial traits, especially lower levels of empathy and higher levels of Callousness, Deceitfulness, and Risk-taking, are directly associated with lower compliance with containment measures. These traits explain, at least partially, the reason why people continue not adhering to the containment measures even with increasing numbers of cases and deaths.

1. Introduction

The spread of COVID-19 (coronavirus disease 2019) led the World Health Organization (WHO, 2020a) to declare it a pandemic in March 2020. Although COVID-19 displays a lower case fatality rate than other coronavirus diseases such as SARS and MERS, it has already claimed the lives of more people than both diseases combined (Rajgor et al., 2020). Due to its high transmissibility, several countries have established measures to delay it, such as mandatory use of masks, constant hygiene of hands, social isolation, periodic disinfection of environment and materials, and even lockdowns. These are called containment measures (WHO, 2020b).

While containment measures aim at "flattening the curve" of contamination (Wilder-Smith et al., 2020), they have been investigated in psychological and psychiatric science for its potential impact in mental health, such as anxiety, depression, phobias, psychological stress, and even suicide (Cao et al., 2020; Gonçalves et al., 2020; Qiu et al., 2020; Thakur and Jain, 2020). Additionally, psychological features and mental health have been studied regarding their expected influence on the success or failure of containment measures (Anderson et al., 2020; Carvalho et al., 2020; Li et al., 2020; Lunn et al., 2020). It is noticeable that compliance with containment measures varies greatly between people. For instance, previous publications consider individual behavior (such as protective behavior, social engagement, and isolation) as crucial to control the spread of COVID-19 (Anderson et al., 2020; Li et al., 2020; Lunn et al., 2020). This is at least partially connected with psychological factors such as personality traits (e.g., Carvalho et al., 2020). For instance, empathic behaviors (e.g., social trust and social responsibility) were associated with greater adherence to measures such as isolation, hygiene, and less hoarding, while individualism was associated with less social distancing and hoarding (Oosterhoff and Palmer, 2020). Studies also suggested that people with higher levels on dark triad traits (machiavellianism, narcissism, and psychopathy) and lower levels of agreeableness were less likely to accept restrictions and comply with isolation measures (O'Connell et al., 2020; Zajenkowski et al., 2020; Zettler et al., 2020). These traits are frequently referred to as antisocial traits, as they are typically present in people diagnosed with Antisocial Personality Disorder (ASPD; APA, 2013; Conway et al.,

Table 1
Descriptive statistics of the sample.

		Week															Total
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
N		86	129	96	112	132	121	161	151	149	65	52	81	70	75	98	1578
Sex %	Male	1.58	5.01	3.23	3.23	4.50	3.61	4.44	5.01	4.37	1.58	1.46	2.60	2.47	1.90	2.98	47.97
	Female	3.87	3.17	2.85	3.87	3.87	4.06	5.77	4.56	5.07	2.53	1.84	2.53	1.96	2.85	3.23	52.03
Ethnicity %	Caucasian	2.92	3.99	3.30	3.74	3.99	3.80	4.94	4.63	4.31	2.47	1.33	2.47	2.47	2.22	2.28	48.86
	Black	2.53	3.55	2.47	3.23	3.99	3.61	4.63	4.50	4.82	1.52	1.77	2.53	1.71	2.47	3.87	47.21
	Others	0.00	0.63	0.32	0.13	0.38	0.25	0.63	0.44	0.32	0.13	0.19	0.13	0.25	0.06	0.06	3.93
Scholar degree %	Lower than high school	0.51	1.58	0.70	0.82	0.95	0.82	1.46	1.20	1.08	0.32	0.89	0.82	0.95	0.95	0.82	13.88
	High school	1.90	2.47	2.66	2.98	3.17	2.60	4.18	3.49	3.74	1.84	1.20	2.09	1.96	1.71	2.47	38.47
	College	1.58	1.39	1.65	1.58	1.96	2.47	2.41	3.11	2.34	0.57	0.63	1.20	1.08	1.20	1.52	24.71
	Graduate	1.46	2.72	1.08	1.71	2.28	1.71	2.15	1.77	2.28	1.39	0.57	1.01	0.44	0.95	1.39	22.94
Country's Region %	North	0.32	0.95	0.44	0.25	0.76	0.63	0.89	0.57	0.82	0.25	0.13	0.51	0.19	0.13	0.38	7.23
	Northeast	0.82	1.20	0.89	1.14	1.01	1.01	1.71	0.95	1.08	0.57	0.76	0.95	0.51	0.70	1.08	14.39
	Midwest	0.44	0.76	0.51	0.51	1.01	0.44	0.63	1.08	1.27	0.19	0.25	0.25	0.32	0.19	0.63	8.50
	Southeast	2.73	3.55	3.17	3.87	3.49	3.23	5.45	4.44	4.57	2.28	1.46	2.47	2.22	2.54	2.54	48.00
	South	1.14	1.71	1.08	1.33	2.09	2.35	1.52	2.54	1.71	0.82	0.70	0.95	1.20	1.20	1.52	21.88
Tested for COVID-19? %	No	5.45	8.17	5.96	7.10	8.37	7.48	1.20	9.51	9.38	3.80	3.17	4.94	4.18	4.37	5.83	97.91
	Yes. negative	0.00	0.00	0.13	0.00	0.00	0.19	0.00	0.00	0.06	0.25	0.13	0.13	0.25	0.19	0.38	1.71
	Yes. positive	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.06	0.00	0.06	0.00	0.13	0.32
Know someone tested for COVID-9? %	No	5.20	7.35	5.20	5.89	6.40	5.39	7.29	6.21	5.83	2.66	1.52	3.04	2.47	2.22	2.53	69.20
	Yes. negative	0.19	0.32	0.57	0.76	1.08	0.82	0.89	0.95	1.46	0.63	0.70	0.95	0.76	1.01	1.65	12.74
	Yes. positive	0.06	0.51	0.32	0.44	0.89	1.46	2.03	2.41	2.15	0.82	1.08	1.14	1.20	1.52	2.03	18.06
Presented symptoms last two weeks? %	No	5.13	7.22	5.70	6.65	7.86	7.16	9.57	8.49	8.87	3.74	2.72	4.56	3.99	4.37	5.64	91.70
	Yes	0.32	0.95	0.38	0.44	0.51	0.51	0.63	1.08	0.57	0.38	0.57	0.57	0.44	0.38	0.57	8.30

Table 2
Descriptive statistics of the pathological traits and empathy indicator.

	Minimum	Maximum	M	SD	Skewness		Kurtosis	
					Statistics	Error	Statistics	Error
Callousness	1.00	4.00	1.56	0.48	1.37	0.06	2.10	0.12
Deceitfulness	1.00	4.00	1.61	0.59	1.29	0.06	1.36	0.12
Hostility	1.00	4.00	2.23	0.68	0.38	0.06	−0.51	0.12
Impulsivity	1.00	4.00	1.99	0.78	0.69	0.06	−0.31	0.12
Irresponsibility	1.00	4.00	1.70	0.56	0.92	0.06	0.49	0.12
Manipulativeness	1.00	4.00	1.82	0.74	0.89	0.06	0.15	0.12
Risk-taking	1.00	4.00	2.02	0.55	0.45	0.06	0.10	0.12
Affective resonance	1.00	5.00	4.22	0.65	−1.29	0.06	1.94	0.12

Note. M = Mean; SD = Standard deviation.

Table 3
Model fit statistics – 1 to 6 profiles solutions.

Solution	LL	Free parameters	BIC	aBIC	AIC	LMR LRT p	BLRT p	Entropy
1	−17,908.15	16	35,934.12	35,883.29	35,848.30	–	–	–
2	−16,188.90	25	32,561.89	32,482.47	32,427.80	< 0.001	< 0.001	**0.892**
3	−15,644.81	34	31,539.98	31,431.97	31,357.61	**< 0.001**	< 0.001	0.891
4	−15,423.05	43	31,162.75	31,026.15	30,932.10	0.553	< 0.001	0.879
5	−15,215.56	52	30,814.04	30,648.85	30,535.12	0.212	< 0.001	0.842
6	−15,086.84	61	**30,622.89**	**30,429.10**	**30,295.69**	0.076	< 0.001	0.856

Note. LL = Loglikelihood; BIC = Bayesian Information Criteria; AIC = Akaike Information Criteria; aBIC = Adjusted Bayesian Information Criteria; LMR LRT p = p value for the Lo-Mendell-Rubin Likelihood Ratio Test; BLRT p = p value for the Bootstrapped Likelihood Ratio Test.

2019).

ASPD is characterized by impairments in personality functioning (identity, self-direction, empathy, and intimacy), specifically related to elevations in Callousness, Deceitfulness, Hostility, Manipulativeness, Impulsivity, Irresponsibility, and Risk-taking traits, as well as the tendency to show lack of empathy (APA, 2013; Anderson, Snider, et al., 2014; Wygant et al., 2016). ASPD's typical traits combined with low levels of empathy are frequently associated with antisocial/rule-breaking behavior, such as criminality and violence (Mariano et al., 2016; Van Langen et al., 2014; Yu et al., 2012). O'Connell et al. (2020) indicated that behaviors that increase the risk of disease transmission

could be understood as one specific form of antisociality. Their results showed that people (N = 131; USA) reporting high levels of antisociality engage in fewer social distancing measures, leading to the conclusion that antisocial individuals may pose health risks to themselves and their community during the COVID-19 pandemic. Similar findings were reported by Zettler et al. (2020; N = 799; Denmark) showing that traits related to dark triad were negatively associated with willingness to accept restrictions, and by Nowak et al. (2020; N = 263; Poland) who found that people scoring low on agreeableness and high on dark triad traits were less likely to comply with the restrictions.

Table 4

Participant's traits, according to the two latent profiles.

Measures	Empathy pattern		Antisocial pattern		d
	M	SD	M	SD	
Affective resonance	0.31	0.03	−0.89	0.11	19.53
Callousness	−0.40	0.03	1.14	0.12	23.31
Deceitfulness	−0.43	0.03	1.23	0.11	27.02
Hostility	−0.30	0.04	0.85	0.06	25.02
Impulsivity	−0.25	0.04	0.72	0.06	21.10
Irresponsibility	−0.31	0.04	0.89	0.07	24.26
Manipulativeness	−0.36	0.03	1.03	0.10	24.44
Risk taking	−0.25	0.04	0.73	0.06	21.32

Note. M = Mean; SD = Standard deviation; d = Cohen's d effect size.

Table 5

Mean comparisons between latent profiles on the compliance with containment measures.

Source	Type III sum of squares	df	Mean square	F	p	Partial η^2
Corrected model	21.735[a]	9	2.42	13.56	< 0.001	0.072
Intercept	175.99	1	175.99	987.97	< 0.001	0.387
Age	1.76	1	1.76	6.41	< 0.001	0.037
Sex	3.88	1	3.88	21.79	< 0.001	0.014
C1	0.09	1	0.09	0.52	0.472	0.000
C2	0.00	1	0.00	0.01	0.915	0.000
C3	2.02	1	2.02	11.33	0.001	0.007
Week	0.18	1	0.18	0.99	0.320	0.001
Containment measures	1.90	3	0.63	3.56	0.014	0.007

Note. a = r^2 = 0.072 ($r^2_{adjusted}$ = 0.067); C1 = tested for COVID-19; C2 = know someone who tested for COVID-19; C3 = presented symptoms of COVID-19 in the last two weeks. The Estimated Marginal Means (EMM), standard deviations (SD) and 95% confidence interval (L = Lower Bound and U = Upper Bound) for the containment measures groups were: group none (*EMM* = 1.44; *SD* = 0.08; *L* = 1.29; *U* = 1.60), group one (*EMM* = 1.26; *SD* = 0.05; *L* = 1.17; *U* = 1.36), group two (*EMM* = 1.31; *SD* = 0.03; *L* = 1.25; *U* = 1.36), and group all (*EMM* = 1.24; *SD* = 0.01; *L* = 1.22; *U* = 1.26).

1.1. The current study

The current study was conducted in Brazil. The country is among those where the COVID-19 pandemic still displays an increasing curve, with controversial and sparse local support for containment measures. Probably part of the Brazilian situation escalation is related to the government stance against the measures presented by WHO and other international scientific and health agencies (CDC, NHS) (Lancet, 2020).

Given the pandemic context, this study aimed at investigating the relationship between antisocial traits and compliance with containment measures. Therefore, we assessed sets of participants over 15 weeks. Based on previous findings (Nowak et al., 2020; O'Connell et al., 2020; Zettler et al., 2020), we hypothesized that people with higher levels of antisocial traits and lower levels of empathy would tend to show more difficulty in adhering to the containment measures.

To our knowledge, this is the first study focused on COVID-19 compliance with the containment measures and antisocial traits to be conducted in a large Latin American sample using a repeated cross-sectional design (Caruana et al., 2015).

2. Method

2.1. Participants

The study sample consisted of 1578 Brazilian adults recruited by convenience over 15 weeks, between March 21 to June 29, 2020. The inclusion criterion was age ≥ 18. Participants' age ranged from 18 to 73.2 years old (*M* = 30.97; *SD* = 10.47). A sensitivity analysis using G*Power (Faul et al., 2007) suggested that with *N* = 1578, we have power = 0.99 to detect effect sizes ≥0.05 in repeated measures ANOVA within-between interaction (*p* = .05).

2.2. Measures

2.2.1. Personality Inventory for DSM-5 (PID-5; Krueger et al., 2012)

The PID-5 is a self-report test aimed at assessing the 25 facets of maladaptive personality traits described in section III of the DSM-5, which can be combined into five domains (negative affect, detachment, antagonism, disinhibition, psychoticism). It is composed of 220 items answered on a 4-point Likert-type scale. In this study, we administered the specific seven PID-5 facets directly representative of the ASPD criteria presented in the Alternative Model for Personality Disorders (AMPD; APA, 2013): Callousness, Deceitfulness, Hostility, Impulsivity, Irresponsibility, Manipulativeness, and Risk-taking (total of 66 items). Studies support the psychometric properties of PID-5 (e.g., Krueger et al., 2012). Cronbach's α varied from 0.74 to 0.90, and McDonald's ω ranged from 0.75 to 0.90.

2.2.2. Affective and Cognitive Measure of Empathy (ACME; Vachon and Lynam, 2015)

The ACME is a self-report scale composed of 36 items and three factors: Cognitive empathy, Affective resonance, and Affective dissonance. We administered the Affective resonance factor (12 items), referring to behaviors that are emphatically congruent to situations. The items are answered on a 5-points Likert scale. The scale is psychometrically sound (Vachon and Lynam, 2015). Cronbach's α was equal to 0.80, and McDonald's ω was equal to 0.82.

2.2.3. Questionnaire about engagement behaviors to COVID-19 containment measures

We elaborated a questionnaire to measure behaviors related to compliance with COVID-19 containment measures. Three questions assessed adherence: "Do you think it is necessary to avoid approaching people as much as possible until the coronavirus situation is controlled?" (social distancing), "Do you think it is necessary to wash your hands and/or use alcohol gel as many times a day until the coronavirus situation is controlled?" (hygiene), and "Do you think it is necessary to use facemask (that protects nose and mouth) in Brazil?" (facemask). Three further questions were about COVID-19 diagnoses: "Did you test for COVID-19?", "Do you know someone who tested for COVID-19?" and "Did you present symptoms of COVID-19 (persistent fever and cough) in the last two weeks?". We used these three last questions as control variables in the statistical analysis.

2.3. Procedure

This study's procedures complied with provisions from the Declaration of Helsinki regarding research on Human participants (World Medical Association [WMA], 2013). All participants signed an informed consent form before participating. Data collection was performed online. We shared the research link on the social media website Facebook, inviting individuals to participate. We conducted data collections on Saturdays and Sundays, from March 21 to June 29. The data collection held from March 21 to March 22 was named Week 1, from March 28 to March 29 was named Week 2, and so on.

2.4. Data analysis

We conducted a latent profile analysis (LPA) to empirically discriminate groups according to their scores on the personality measures. LPA is a person-centered approach recommended to the investigation of different subpopulations, according to their similarity on scores of a set of continuous observed variables (Goodman, 1974; Muthén, 1989), and

Table 6

Mean comparisons between compliance with containment measures groups in the personality traits.

Source		Type III sum of squares	df	Mean square	F	p	Partial η²
Corrected model	Callousness	26.482[a]	9	2.94	13.61	0.000	0.072
	Deceitfulness	65.853[b]	9	7.32	23.75	0.000	0.120
	Hostility	24.589[c]	9	2.73	6.14	0.000	0.034
	Impulsivity	13.258[d]	9	1.47	2.41	0.010	0.014
	Irresponsibility	32.474[e]	9	3.61	12.09	0.000	0.065
	Manipulativeness	66.511[f]	9	7.39	14.36	0.000	0.076
	Risk-taking	39.697[g]	9	4.41	15.70	0.000	0.083
	Affective resonance	61.905[h]	9	6.88	17.95	0.000	0.093
Intercept	Callousness	251.19	1	251.19	1161.61	0.000	0.426
	Deceitfulness	345.35	1	345.35	112.85	0.000	0.417
	Hostility	373.80	1	373.80	839.87	0.000	0.349
	Impulsivity	277.94	1	277.94	455.34	0.000	0.225
	Irresponsibility	295.28	1	295.28	989.47	0.000	0.387
	Manipulativeness	421.33	1	421.33	818.87	0.000	0.343
	Risk-taking	438.19	1	438.19	1559.41	0.000	0.499
	Affective resonance	752.12	1	752.12	1963.12	0.000	0.556
Age	Callousness	1.35	1	1.35	47.86	0.000	0.030
	Deceitfulness	26.26	1	26.26	85.22	0.000	0.052
	Hostility	19.50	1	19.50	43.81	0.000	0.027
	Impulsivity	7.13	1	7.13	11.69	0.001	0.007
	Irresponsibility	16.28	1	16.28	54.56	0.000	0.034
	Manipulativeness	23.92	1	23.92	46.50	0.000	0.029
	Risk-taking	9.33	1	9.33	33.21	0.000	0.021
	Affective resonance	18.90	1	18.90	49.33	0.000	0.030
Sex	Callousness	4.28	1	4.28	19.80	0.000	0.012
	Deceitfulness	22.31	1	22.31	72.41	0.000	0.044
	Hostility	2.22	1	2.22	4.99	0.026	0.003
	Impulsivity	0.39	1	0.39	0.64	0.426	0.000
	Irresponsibility	9.51	1	9.51	31.87	0.000	0.020
	Manipulativeness	21.77	1	21.77	42.31	0.000	0.026
	Risk-taking	19.17	1	19.17	68.23	0.000	0.042
	Affective resonance	15.69	1	15.69	4.96	0.000	0.025
Week	Callousness	0.62	1	0.62	2.88	0.090	0.002
	Deceitfulness	0.67	1	0.67	2.17	0.141	0.001
	Hostility	0.28	1	0.28	0.64	0.425	0.000
	Impulsivity	1.91	1	1.91	3.13	0.077	0.002
	Irresponsibility	0.85	1	0.85	2.86	0.091	0.002
	Manipulativeness	0.46	1	0.46	0.90	0.342	0.001
	Risk-taking	0.01	1	0.01	0.03	0.868	0.000
	Affective resonance	2.37	1	2.37	6.20	0.013	0.004
C1	Callousness	0.36	1	0.36	1.66	0.198	0.001
	Deceitfulness	0.39	1	0.39	1.26	0.263	0.001
	Hostility	0.39	1	0.39	0.87	0.352	0.001
	Impulsivity	0.00	1	0.00	0.00	0.994	0.000
	Irresponsibility	0.08	1	0.08	0.25	0.616	0.000
	Manipulativeness	0.15	1	0.15	0.30	0.584	0.000
	Risk-taking	1.05	1	1.05	3.73	0.053	0.002
	Affective resonance	0.05	1	0.05	0.14	0.705	0.000
C2	Callousness	0.34	1	0.34	1.59	0.207	0.001
	Deceitfulness	0.00	1	0.00	0.01	0.919	0.000
	Hostility	0.18	1	0.18	0.40	0.528	0.000
	Impulsivity	2.23	1	2.23	3.66	0.056	0.002
	Irresponsibility	0.00	1	0.00	0.00	0.953	0.000
	Manipulativeness	2.02	1	2.02	3.92	0.048	0.002
	Risk-taking	0.01	1	0.01	0.04	0.850	0.000
	Affective resonance	1.72	1	1.72	4.49	0.034	0.003
C3	Callousness	1.20	1	1.20	5.55	0.019	0.004
	Deceitfulness	3.36	1	3.36	1.89	0.001	0.007
	Hostility	1.84	1	1.84	4.12	0.042	0.003
	Impulsivity	1.83	1	1.83	3.00	0.084	0.002
	Irresponsibility	1.79	1	1.79	6.01	0.014	0.004
	Manipulativeness	6.73	1	6.73	13.08	0.000	0.008
	Risk-taking	2.30	1	2.30	8.19	0.004	0.005
	Affective resonance	0.38	1	0.38	0.99	0.320	0.001

Table 6 (*continued*)

Source		Type III sum of squares	df	Mean square	F	p	Partial η²
Containment measures	Callousness	5.97	3	1.99	9.21	0.000	0.017
	Deceitfulness	2.41	3	0.80	2.60	0.051	0.005
	Hostility	1.47	3	0.49	1.10	0.347	0.002
	Impulsivity	0.47	3	0.16	0.25	0.858	0.000
	Irresponsibility	0.04	3	0.01	0.05	0.986	0.000
	Manipulativeness	2.39	3	0.80	1.55	0.200	0.003
	Risk-taking	2.28	3	0.76	2.71	0.044	0.005
	Affective resonance	12.85	3	4.28	11.18	0.000	0.021

Note. a = r^2 = 0.072 ($r^2_{adjusted}$ = 0.067); b = r^2 = 0.120 ($r^2_{adjusted}$ = 0.115); c = r^2 = 0.034 ($r^2_{adjusted}$ = 0.028); d = r^2 = 0.014 ($r^2_{adjusted}$ = 0.008); e = r^2 = 0.065 ($r^2_{adjusted}$ = 0.060); f = r^2 = 0.076 ($r^2_{adjusted}$ = 0.071); g = r^2 = 0.083 ($r^2_{adjusted}$ = 0.077); h = r^2 = 0.093 ($r^2_{adjusted}$ = 0.088); C1 = tested for COVID-19; C2 = know someone who tested for COVID-19; C3 = presented symptoms of COVID-19 in the last two weeks. The Estimated Marginal Means (EMM), standard deviations (SD) and 95% confidence interval (L = Lower Bound and U = Upper Bound) for the containment measures groups in each ASPD trait were: Callousness - group None (EMM = 1.75; SD = 0.09; L = 1.58; U = 1.92), group One (EMM = 1.65; SD = 0.05; L = 1.54; U = 1.75), group Two (EMM = 1.66; SD = 0.03; L = 1.61; U = 1.72), and group All (EMM = 1.52; SD = 0.01; L = 1.49; U = 1.55); Deceitfulness - group None (EMM = 1.85; SD = 0.10; L = 1.65; U = 2.06), group One (EMM = 1.55; SD = 0.06; L = 1.43; U = 1.67), group Two (EMM = 1.64; SD = 0.03; L = 1.58; U = 1.71), and group All (EMM = 1.60; SD = 0.02; L = 1.57; U = 1.63); Hostility- group None (EMM = 2.31; SD = 0.12; L = 2.07; U = 2.56), group One (EMM = 2.27; SD = 0.07; L = 2.12; U = 2.41), group Two (EMM = 2.28; SD = 0.04; L = 2.20; U = 2.36), and group All (EMM = 2.21; SD = 0.02; L = 2.17; U = 2.25); Impulsivity - group None (EMM = 2.06; SD = 0.15; L = 1.78; U = 2.35), group One (EMM = 2.05; SD = 0.09; L = 1.87; U = 2.22), group Two (EMM = 1.99; SD = 0.05; L = 1.89; U = 2.08), and group All (EMM = 1.98; SD = 0.02; L = 1.94; U = 2.03); Irresponsibility - group None (EMM = 1.67; SD = 0.10; L = 1.47; U = 1.87), group One (EMM = 1.71; SD = 0.06; L = 1.59; U = 1.83), group Two (EMM = 1.69; SD = 0.03; L = 1.63; U = 1.76), and group All (EMM = 1.69; SD = 0.02; L = 1.66; U = 1.73); Manipulativeness - group None (EMM = 2.08; SD = 0.13; L = 1.82; U = 2.35), group One (EMM = 1.79; SD = 0.08; L = 1.63; U = 1.94), group Two (EMM = 1.86; SD = 0.04; L = 1.77; U = 1.94), and group All (EMM = 1.81; SD = 0.02; L = 1.77; U = 1.85); Risk-taking - group None (EMM = 2.24; SD = 0.10; L = 2.04; U = 2.43), group One (EMM = 2.10; SD = 0.06; L = 1.99; U = 2.22), group Two (EMM = 2.04; SD = 0.03; L = 1.98; U = 2.11), and group All (EMM = 2.00; SD = 0.01; L = 1.97; U = 2.03); Affective resonance - group None (EMM = 3.85; SD = 0.12; L = 3.62; U = 4.01), group One (EMM = 4.05; SD = 0.07; L = 3.92; U = 4.19), group Two (EMM = 4.09; SD = 0.04; L = 4.01; U = 4.16), and group All (EMM = 4.27; SD = 0.02; L = 4.23; U = 4.30).

it has been applied in personality research (Ferguson and Hull, 2018). The application of LPA to personality traits helps in identifying groups of individuals because personality traits are latent constructs that distinguish people according to their individual differences. In the case of containment measures, we do not assume the existence of a latent factor, but observable behaviors. For this analysis, we used the following indicators: scores on Affective resonance (ACME), Callousness, Deceitfulness, Hostility, Impulsivity, Irresponsibility, Manipulativeness, and Risk-taking (PID-5). Previously to this analysis, we standardized the scores in z (M = 0; SD = 1). As standard recommendations (Nylund et al., 2007) we used the following indicators for deciding the best number of profiles to be retained: the average probabilities for the most likely profile membership (entropy; Ramaswamy et al., 1993) should be higher than 0.80; lower values of Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC), and sample-size adjusted BIC (aBIC) indicate the best model fit; non-significant p values for the Lo–Mendell–Rubin likelihood ratio test (LMR-LRT; Lo et al., 2001) and Bootstrapped Likelihood Ratio Test (BLRT) indicate that a *k*-1 profiles model fits the data significantly better than the model with *k* profiles; models with profiles containing < 5% of the sample should be avoided; theoretical support should exist for the model retained, and profiles should be interpretable (Marsh et al., 2009).

Comparisons between means were conducted via bootstrap ANCOVA to verify differences in compliance with the containment measures (social distancing, hygiene, and facemask) over 15 weeks, using the groups that were identified through LPA, and via bootstrap MANCOVA using the scores in personality traits. The significance level was p < .05. ANCOVA and MANCOVA are good analytical options with no specific assumptions on the relationship of variables in the model. They are also recommended when the focus of the results is not on the multiple administrations (Shaw and Mitchell-Olds, 1993), as this variable usually enters the model as a covariate. Based on previous literature on ASPD traits, we controlled the variables sex (Cale and Lilienfeld, 2002) and age (Newton-Howes et al., 2015). According to evidence, these variables can bias results, as men and young individuals are more prone to present high scores in ASPD traits. The three items from the COVID-19 behaviors questionnaire were also used as

covariables, as we are considering that the proximity of an individual with COVID-19 can impact on adherence to containment measures. For mean comparisons, we calculated the Estimated Marginal Means (i.e., the mean of the variable after adjusting for all covariates in the model) of the independent variable, and performed a pairwise comparison between means applying the Bonferroni correction.

We also divided participants into four groups according to adherence to containment measures: None = people who think that containment measures are not important (*n* = 29); One = people who think that one of the containment measures is important (*n* = 81); Two = people who think that two of the containment measures are important (*n* = 266); All = people who think that all three containment measures are important (*n* = 1202). We conducted ANOVA with a bootstrapping procedure to compare groups in the personality measures. We used 0.05 as significance level, and the partial eta squared was used as effect size indicator. The partial eta squared was interpreted as 0.01 (small), 0.09 (medium) and 0.25 (large) (Cohen et al., 2001). We performed analyses in SPSS version 23.

3. Results

Table 1 reports descriptive statistics on basic sociodemographic and specific information related to COVID-19.

The total number of participants was 1578 adults, mostly female (52.03%), Caucasian (48.86%), residents in the southeast region of Brazil (48%), and with high school degrees (38.47%). Only 32 participants reported being tested for COVID-19, five of those tested positive. In addition, 285 participants reported knowing someone who tested positive for COVID-19. Table 2 presents the descriptive statistics for the personality traits. Although skewness and kurtosis were somewhat deviating from normality (Callousness, Deceitfulness, and Affective resonance), we can assume a general tendency to the normality of the data.

For the latent profile analysis (LPA), we tested solutions for 1 to 6 profiles solutions, as indicated by the data. We did not perform solutions with more than six profiles, as the 7-profiles solution included a profile with < 5% of participants.

The BIC, aBIC, AIC and BLRT indices did not clearly indicate the best solution because they favor solutions with a higher number of profiles (BIC, aBIC and AIC decreased in every solution in which a profile was added and the BLRT p-values was significant in all observed solutions). It is expected that the values of BIC, aBIC and AIC will decrease in solutions with a higher number of factors, even though it is not the most adequate (Nylund-Gibson and Choi, 2018).

We observed a substantial decrease between 1-profile solution and 2-profiles solution ($\neq$ 3373.12 while the maximum decreased between any other two profiles was 1021.91), favoring the 2-profiles solution. The LMR LRT p-value indicated the 3-profiles solution as the best solution (non-significant p-value). The 2-profiles solution had a higher entropy, although entropy was good for all profiles solutions (< 0.80). Table 3 shows the model fit statistics for all profiles solutions.

The fit statistics were incongruent to indicate the best solution. The 3-profiles were a satisfactory solution. However, as the 2-profiles solution presented higher entropy, the higher decreased in BIC, aBIC, and AIC values, and better interpretability of the observed profiles, we chose to retain this solution for further analyses. The 2-profiles solution showed the average probabilities for the most likely profile membership to be higher than 0.80 (0.94 for profile 1, and 0.98 for profile 2), and both profiles were composed by > 5% of the sample. Table 4 presents the characteristics of the two observed profiles.

The antisocial pattern profile (n = 405) presented higher scores in Callousness, Deceitfulness, Hostility, Impulsivity, Irresponsibility, Manipulativeness, and Risk-taking, as well as lower scores in Affective resonance. On the other hand, the empathy pattern profile (n = 1173) presented higher scores in Affective resonance and lower scores in ASPD typical traits. Table 5 shows the comparison (ANCOVA) between latent profiles and their compliance with containment measures.

The profiles (antisocial pattern and empathy pattern) differed significantly on the age, sex, compliance with containment measures, and C3 variables. The estimated marginal means of containment measures groups revealed that the group None had the highest mean on profiles (M = 1.44, SD = 0.08), suggesting its proximity with the antisocial pattern. The group All had the lowest mean (M = 1.24, SD = 0.01), even after controlling for all covariates. The comparison between groups indicated that the groups None and All did not present significant differences, although showing a large effect size (d = 12.69).

Table 6 shows the comparison (MANCOVA) between the groups according to the compliance with containment measures in the personality traits.

The ASPD scores presented significant differences in the age covariable. A similar result was observed for sex, except for Impulsivity. The Affective resonance score showed significant differences for the week variable. Manipulativeness and Affective resonance were the only scores that exhibited significant differences between people who know someone who tested for COVID-19 and people that did not. All scores, excepted Impulsivity and Affective resonance, presented significant differences between people with symptoms of COVID-19 in the last two weeks and people without symptoms. Callousness, Risk-taking, and Affective resonance differed significantly between groups of compliance with containment measures. The estimated marginal means of containment measures groups showed that the group None presented higher means in ASPD scores, except for Irresponsibility and Affective Resonance. The group All exhibited the lower mean in the following scores: Callousness, Hostility, Impulsivity, Manipulativeness, and Risk-taking; and the higher mean in Affective Resonance. The comparison between groups indicated significant differences between the group All and the three other groups in Affective Resonance, as well as between the group All and the group Two in the Callousness facet.

4. Discussion and conclusions

Containment measures have been the most effective way to flatten the curve of COVID-19 contamination (Wilder-Smith et al., 2020).

However, despite the benefits of slowing the spread of the virus, previous studies found that some people are more likely to comply with these measures than others (e.g., Carvalho et al., 2020; Oosterhoff and Palmer, 2020). Additional studies showed that personality traits play an essential role in adhering to containment measures, especially antisocial and empathy traits (O'Connell et al., 2020; Zajenkowski et al., 2020; Zettler et al., 2020). We investigated associations of these traits with adherence to COVID-19 containment measures in a large Brazilian adult sample. Unveiling these associations should assist in establishing public health actions to increase compliance with containment measures by the population. Overall, our findings were in the hypothesized direction, suggesting that adherence to containment measures is more challenging to people with a pattern of antisociality in comparison to those who have an empathy pattern.

The latent profile analysis revealed the existence of two groups: people with a higher tendency to antisocial traits (antisocial pattern group) and people with a higher tendency to empathy (empathy pattern group). The antisocial pattern group presented higher scores in all ASPD typical traits (Callousness, Deceitfulness, Hostility, Impulsivity, Irresponsibility, Manipulativeness, and Risk-taking) and lower scores in Affect resonance (an indicator of empathy). The empathy pattern group presented the opposite. The existence of such groups is confirmed by previous literature (e.g., Anderson, Sellbom, et al., 2014; APA, 2013; Conway et al., 2019; Wygant et al., 2016).

The ANCOVA analysis demonstrated that the antisocial pattern profile differed significantly from the empathy pattern profile on age, sex, compliance with containment measures, and in presented symptoms of COVID-19 in the last weeks. Even after controlling for all covariates, the group represented by individuals that reported not adhering to any containment measures (group None) kept the highest mean on profiles, indicating its proximity with the antisocial pattern. The findings observed using the MANCOVA analysis also suggested that people who complied less with the containment measures had a tendency to show elevation on the ASPD scores (with the exception of Irresponsibility), and low scores on Affective resonance, even after controlling for all covariates. The only variable that showed significant differences between all containment measures groups was the Affective Resonance. These findings confirm the previous literature on the association between personality traits and adherence to COVID-19 containment measures (e.g., Carvalho et al., 2020), and more specifically the association with antisocial traits and empathy (Nowak et al., 2020; O'Connell et al., 2020; Oosterhoff and Palmer, 2020; Zettler et al., 2020).

Our study was conducted with a large sample, with representatives from all regions of Brazil, which reflected the country's reality over the weeks (i.e., a gradual increase in cases and knowledge of people that tested for COVID-19). Additionally, it was possible to observe the tendency for underreporting of cases because: even though people had symptoms in the last two weeks (8.30%), few people were tested for COVID-19 (2.03%). These results indicate not only possible underreporting but also the country's authorities' low attention to the issue, as previously exposed (Lancet, 2020).

Our findings indicated that antisocial traits, especially lower levels of empathy and higher levels of Callousness and Risk-taking, are directly associated with compliance with containment measures. These traits explain, at least partially, the reason why people continue not adhering to the containment measures even with the increasing numbers of cases and deaths. Exposing oneself and others to risk, even when it can be avoided, is a typical trait for people with antisocial tendencies (e.g., Krasnova et al., 2019; Yu et al., 2012), and with low levels of empathy (Mariano et al., 2016; Van Langen et al., 2014).

Our findings can be useful for public health policies, e.g., through screenings that demonstrate an elevation in these traits, interventions can be carried out aiming at greater awareness and consequent compliance with containment measures. We suggest that further studies be carried out investigating the interaction of these traits with other

variables.

Our study's findings should be considered in light of its main methodological limitations. First, although our sample is large and covering all regions of the country, it cannot be considered representative of the Brazilian population, which may imply a bias in the generalization of the results. Second, the data collection carried out over the weeks did not assess the same participants, which would characterize a longitudinal study and would allow tracking how antisociality affects exposure during the COVID-19 pandemic. Third, employing the latent profile analysis method for the classification of the sample in groups can imply limitations, such as an overestimation of groups (Bauer and Curran, 2003).

CRediT authorship contribution statement

	Fabiano K Miguel	Gisele M Machado	Giselle Pianowski	Lucas de F Carvalho
Term	X	X	X	X
Conceptualization	X	X	X	X
Data curation	X	X	X	X
Formal analysis	X	X	X	X
Funding acquisition				
Investigation	X	X	X	X
Methodology	X	X	X	X
Project administration	X	X	X	X
Resources	X	X	X	X
Software	X	X	X	X
Supervision	X			X
Validation	X	X	X	X
Visualization	X	X	X	X
Roles/Writing – original draft	X	X	X	X
Writing – review & editing	X	X	X	X

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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