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Article

The Correlation between Policy Stringency and Compliance with Restrictions to Reduce the Spread of COVID-19

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Abstract: Upon the outbreak of the COVID-19, countries worldwide developed policies with the goal to introduce restrictive measures geared towards mitigating the spread of the virus. Although these health initiatives were put in place through top-down public directives, they relied heavily on the cooperation of citizens who had to be willing to carry them out. As a consequence, we could observe differences in compliance with governmental restrictions within and between countries. Increasing policy stringency was the method adopted overall to promote people's compliance. This article used survey data from 10308 participants in Brazil to examine whether there was a positive correlation between policy stringency and compliance with restrictive measures to reduce the spread of COVID-19. The results revealed, however, that there was no direct influence of policy stringency on people's health behaviors. Accordingly, I hypothesized that individual differences in personality traits were one of the drivers behind policy compliance, as they would support self-interests such as the duty to support authorities as well as the perceived health risks of certain behaviors and ultimately motivate compliance. The findings' implications for both compliance research and for authorities wanting to nurture voluntary compliance with public health orders are discussed and suggestions are provided.

Keywords: Big Five; compliance; COVID-19; personality traits; policy-making; policy stringency

1. Introduction

In recent years, we have been living through difficult times. The COVID-19 pandemic has affected an immense number of people worldwide and countries have grappled with the challenge of controlling the outbreak of the disease within and between borders. In this scenario, several measures were introduced with the goal to mitigate the spread of the virus, such as lockdowns, closing schools, and promoting social distancing. Although some of these initiatives were put in place through top-down public directives, they relied heavily on the cooperation of citizens who had to be willing to carry them out. Therefore, the situation provided an opportunity for the study of the overlap between pandemic management strategies, policy stringency, and personality psychology.

The COVID-19 pandemic has yielded the development of several behavioral guidelines intended to mitigate transmission. They have been largely introduced via policy enacted by local governments. However, evidence points to an overall popular disregard for many of these injunctions, given their standardized nature [1]. Such an outcome can be justified by research suggesting that "persuasive appeals are more effective in influencing behavior when they are tailored to individuals' unique psychological characteristics" [2], p. 12714. However, by and large, countries attempted to ensure compliance by increasing their policies stringency [3], which seems to have backfired. In this sense, it is relevant to understand the drivers behind people's motivation to comply with restrictive public policies aimed at implementing behavioral conducts intended to mitigate transmission.

As the possibility of a new pandemic can never be discarded, this paper aims to explore the interplay between psychological processes and macro-level policies in the deployment of virus

controlling strategies and to provide some real-world insights to minimize the risk of not complying with COVID-19 transmission mitigation behavioral guidelines. To that end, this paper draws upon survey data from 10,308 participants across all the states in Brazil and is set out to respond to the following research question: *Is there a positive correlation between policy stringency and transformation in health behavior?* In doing so, it provides a series of contributions.

First, it sheds a light on the role personalities play in influencing people's willingness to comply with policy-introduced behavioral conducts intended to control the virus outbreak, which explains why transmission occurs more often among certain individuals but not others. This is a topic of curiosity among researchers, who have been interested in identifying since the outset of the COVID-19 pandemic who are the citizens complying with the policies. Second, if we accept that, unfortunately, this is not the last world crisis we are facing in history, making sense of people's motivation to comply with restrictive public policy during pandemics is useful not only now but also for future events [4]. Thus, this paper highlights the relevance of the implementation measures that take into account individuals' personal drivers. Finally, it contributes to the scientific literature on policy design and compliance during exceptional situations [6–8]. Although there is a fair share of studies on differences with regards to the compliance with policy implementing transmission mitigation behavioral guidelines [9,10], there is a paucity of works examining personality traits as drivers and barriers to policy compliance during exceptional circumstances. Therefore, this paper links the literature of policy-making, psychological responses to restrictive guidelines, and persuasive mass communication [11] to emphasize the importance of incorporating behavioral science into governments' responses to crises.

1.1. Persuasive Mass Communication, Policy-Making and the Five-Factor Model

Persuasive mass communication can be construed as the process whereby large groups of people are influenced to behave in a similar fashion, to share tantamount beliefs, and to carry out attitudes consistent with the communicator's stance [2]. Thus, studies on persuasive mass communication aim to develop/identify strategies to advance the influential power of messages [12,13]. Amid several theories, the theory of psychological persuasion, suggests that communication is most influential if adjusted to people's unique psychological drivers [2], i.e. the most effective way to sway someone's opinion is by appealing to their motivational tendencies [14–16]. In situations such as the current COVID-19 pandemic, however, it is unrealistic to expect governments and international health organizations would be able to make the messages either personalized or individually-targeted, although most certainly they would benefit from persuasive mass communication. Because there is a strong positive correlation between motivational tendencies and personality traits [17], as the latter has the power to yield differences in beliefs and behaviors even when people are exposed to similar messages, understanding these would help public authorities to tailor their message in a more influential way.

The attempt to make sense of human behavior is not a novelty. Over the years, there has been much debate over the probabilistic nature of personality traits, i.e. their variance according to contextual external stimuli [18–21]. Currently, however, the scientific literature seems to accept the interplay between the environment and psychobiological forces on the formation of five main personality traits underpinning human behavior [22–26]. It is in this scenario that this paper examines how diverse personalities respond differently to similar messages from authorities, which ultimately influences the willingness of individuals to comply with behavioral changing policies.

Table 1. Inspired by DeYoung [22] and McCrae and John [25].

	Verbal Label	Conceptual Definition
Meta-traits	Stability	Maintenance of objectives, interpretations, and strategies from disruption by impulses
	Plasticity	Creation of new objectives, interpretations, and strategies

Big Five	Extraversion	Describes an energetic demeanour toward life, which engenders features such as sociability, assertiveness and positive emotionality
	Neuroticism	On one extreme entails emotional stability. On the other, implies negative emotionality
	Openness	Implies the breadth, originality, and complexity of person's mental abilities and experiential life
	Conscientiousness	The impulse to be driven and industriousness
	Agreeableness	Proclivity to concurrence with others usually manifested through altruism, trust, and modesty
	Assertiveness	Drive towards a goal
	Enthusiasm	Gratification of attainment of actual or imagined goal
	Volatility	Proactive behaviour to avoid or eradicate threats
	Withdrawal	Represented through anxiety and/or depression
	Intellect	Development of logical patterns in abstract and semantic information
Facets	Openness to experience	Spatial and temporal correlational patterns in sensory and perceptual information
	Industriousness	Represented through dutifulness and delayed gratification
	Orderliness	Obedience to rules to avoid chaos
	Compassion	Represented through empathy, i.e. emotional attachment to and concern for others
	Politeness	Suppression of aggressive behaviour and avoidance of or norm-violating conduct

The five-factor model (FFM) – also known as the ‘Big Five’ – is an empirical-based taxonomy of personality that converges a myriad of human behavior dispositions into five descriptive traits, namely neuroticism (or emotional stability), extraversion, openness (or intellect/imagination), agreeableness, and conscientiousness [23–25]. Put simply, the model is an empirical generalization about the covariation of personality traits.

The correlation between the five personality traits and adequate health behaviors has been explored in the literature prior to the recent condition provoked by the COVID-19 pandemic. For instance, people who score high in trait Openness present a proclivity to explore new things, are prone to overlook rules, and deviate from cultural norms. This behavior exposes them to the risk of contracting infectious diseases and makes them less likely to comply with policies aimed at neutralizing pathogens threats [27–30]. Conversely, people high in Openness seem to be more capable of accurately assessing situations, which might contribute to their compliance with health behaviors such as the use of facial coverings outside the home [31].

As to the other personality traits, a high score in Conscientiousness, for example, is a good indicator that the individual is prone to comply with norms [32,33] and civic duties [34], which can be translated to higher adherence to medical advice [35] and more wariness of unhealthy behaviors [36,37]. A high score in Neuroticism tends to translate into fear and stress, which can also be perceived in relation to infectious diseases [38,39]. A result of that fear, for example, is the adoption of germ avoidance behaviors [38,40]. High Extraversion is usually associated with risky health behaviors [36,41], as, for example, a higher degree of exposure to germs [38]. Finally, it has been suggested that

people with low scores in Agreeableness tend to be less inclined to comply with orders and break rules in general [42,43](Fiddick et al., 2016; Roccas et al., 2002).

This swift appraisal of the literature demonstrates how people's health behaviors can be affected by their different personality traits, which is of crucial relevance for understanding why policies trying to override such individuals' differences are successful in certain places but not in others. Furthermore, understanding the motivation behind people's behavior is a crucial step for public authorities to improve their policy-making techniques and achieve their goal of changing people's health behavior.

2. Materials and Methods

2.1. Participants

This study investigates whether there is a positive correlation between policy stringency and transformation in health behavior. It draws upon survey data collected between April and September 2020 from 10308 participants in Brazil by the Imperial College London Big Data Analytical Unit and YouGov Plc. 2020 (<https://github.com/YouGov-Data/covid-19-tracker>) [44]. The questions in the survey cover data on testing, symptoms, self-isolating in response to symptoms, and the ability and willingness to self-isolate if needed. It also looks at behaviors, including going outdoors, working outside the home, contact with others, hand washing, and the extent of compliance with 20 common preventative measures. In this study, only health-related items were under analysis. The full list of items can be found in Supplementary Materials.

2.2. Measures

Independent variable: Stringency of governmental policy. As to policy stringency, I resorted to the COVID-19 Government Response Stringency Index (<https://ourworldindata.org>), which assesses nine response indicators – among others school closure, workplace closure, travel bans, implementation of public information campaign, restrictions on internal movement – and assigns scores to each policy measure predicated on whether their implementation is absent, targeted or general. Then, the scores are averaged to create a composite stringency index, ranging from 0 to 100 [3].

As per factorial analysis (see next sections), two were the dependent variables tested in this study:

Dependent variable 1: Social gathering. Here, the database that was made available by the Imperial College London Big Data Analytical Unit and YouGov Plc. 2020 was once again used. Participants were asked to indicate the extent to which they avoided small, medium, and large-sized social gatherings. Their answers were registered on a scale from 1 to 5 (anchors: 1= Always, 2=Frequently, 3=Sometimes, 4=Rarely, 5=Not at all).

Dependent variable 2: The use of facial coverings. Participants were asked to indicate whether they wore a face mask at grocery stores/supermarkets and clothing/footwear shops. Once again, their answers were registered on a scale from 1 to 5 (anchors: 1= Always, 2=Frequently, 3=Sometimes, 4=Rarely, 5=Not at all).

Control variables. As part of the online survey conducted by the Imperial College London Big Data Analytical Unit and YouGov Plc. 2020 [44], various sociodemographic variables were also assessed. These were used as control variables in the analysis presented in this article. Of interest for this study were participants reported age and gender.

3. Results

3.1. Exploratory Factor Analysis of the Questionnaire

To explore the factorial structure of the survey on perceptions around the behaviors changing in response to Covid-19 in the Brazilian setting, the 25 health-related items of the questionnaire were subjected to exploratory factor analysis (EFA) with oblique rotation (obli-min). The Kaiser-Meyer-

Olkin measure verified the sampling adequacy for the analysis, $KMO = .88$. Bartlett's test of sphericity Chi-Square (300) = 22691.64, $p < .001$, indicating that the correlation structure is adequate for factor analyses. The principal components factor analysis with a cut-off point of .40 and the Kaiser's criterion of eigenvalues greater than 1 (see Field [45]; Stevens [46]) yielded a six-factor solution as the best fit for the data, accounting for 49.56% of the variance. The results of the EFA are presented in Table 2. Items 5, 12, 16, and 20 proved to be problematic and did not load with any factor. Thus, I decided to take them out of my model.

Table 2.

	FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4	FACTOR 5	FACTOR 6
QUESTION 13	.858					
QUESTION 12	.780					
QUESTION 14	.773					
QUESTION 11	.511					
QUESTION 15	.449					
QUESTION 3		.694				
QUESTION 2		.589				
QUESTION 4		.584				
QUESTION 19		.554				
QUESTION 1		.489				
QUESTION 5						
QUESTION 23			.854			
QUESTION 22			.795			
QUESTION 25			.769			
QUESTION 9				.666		
QUESTION 24				.578		
QUESTION 6				.446		
QUESTION 20						
QUESTION 16						
QUESTION 10					.700	
QUESTION 7					.496	
QUESTION 8					.453	
QUESTION 18						.720
QUESTION 17						.684
QUESTION 21						.548

Notes. Extraction Method: Principal Component Analysis; Rotation Method: Oblimin with Kaiser Normalization.

3.2. Confirmatory Factor Analysis

The six-factor model that emerged in the EFA was further examined by using confirmatory factor analysis (CFA) in AMOS (see Figure 1). Amos is a software for structural equation modeling [47]. The comparative fit index (CFI) runs a comparison between the target model and the fit of an independent model, that is, a model where there is an assumption that the variables are not correlated. Values that approach 1 indicate good fit [48]. The root mean square error of approximation (RMSEA) tells us whether the model, with unknown but optimally selected parameter estimates, fits the populations' covariance matrix. Any number within 0.05 and 0.10 is considered to indicate a fair

fit. The standardized root mean square residual (SRMR) compares the square root of the difference between the residuals of the sample covariance matrix and the hypothesized covariance model. Values that approach 0 signal good model fit. However, an SRMR can go as high as 0.08 and still be considered acceptable [49]. The Akaike Information Criterion (AIC) [50] is a fit index that is fitted to compare non-nested models estimated with the same data. The goal is to determine which model is more parsimonious. The Bayesian information criterion (BIC) [51] is another criterion that chooses a model relative to its likelihood function and number of parameters with a penalty for a larger number of parameters.

I did not allow any error terms to covary and arrived at the fitting model described below (CFI =.90, RMSEA =.04, SRMR =.04, Chi-Square= 4685.8, and $df = 194$, $p < .001$, AIC =4847.84, BIC =4848.21). Although this model reached a reasonably acceptable fit, loading factors were under .7 for all the questions under factors 2, 4, 5, and 6, which means they were not strong factors under CFA even though they were under EFA. Conversely, factors 1 and 3 worked well under CFA, as loading factors were over .7 for all the questions (exceptions can be observed in Figure 1). Moreover, the covariance between factors 1 and 3 is low (i.e., under .5), which reiterates the discriminate validity between them.

In the end, the model suggests that the questionnaire effectively measures two different factors: Social gathering (questions 12, 13, 14) and face-covering in public areas (questions 22, 23, 25).

The five-factor model, which had emerged in the exploratory factor analyses, was further examined by using confirmatory factor analysis (see Figure 3). Again, we did not allow any error terms to covary and arrived at a better fitting model than the four-factor model described above (CFI =.89, RMSEA =.07, SRMR =.11, $\chi^2=823.92$, and $df =165$, $p < .001$, AIC =913.92, BIC =1123.99). Although this model reached a reasonably acceptable fit, other possible sources of variance were explored in order to improve the model fit. Because direct comparison of the creativity items showed remarkable differences between men and women, a multiple-group approach based on gender was followed. Computing the models for each sex separately revealed a slightly better fit for women than for men. While the RMSEA went down, the other fit indices hardly improved, showing that the multiple-group model did not improve the overall model fit (see Table 2).

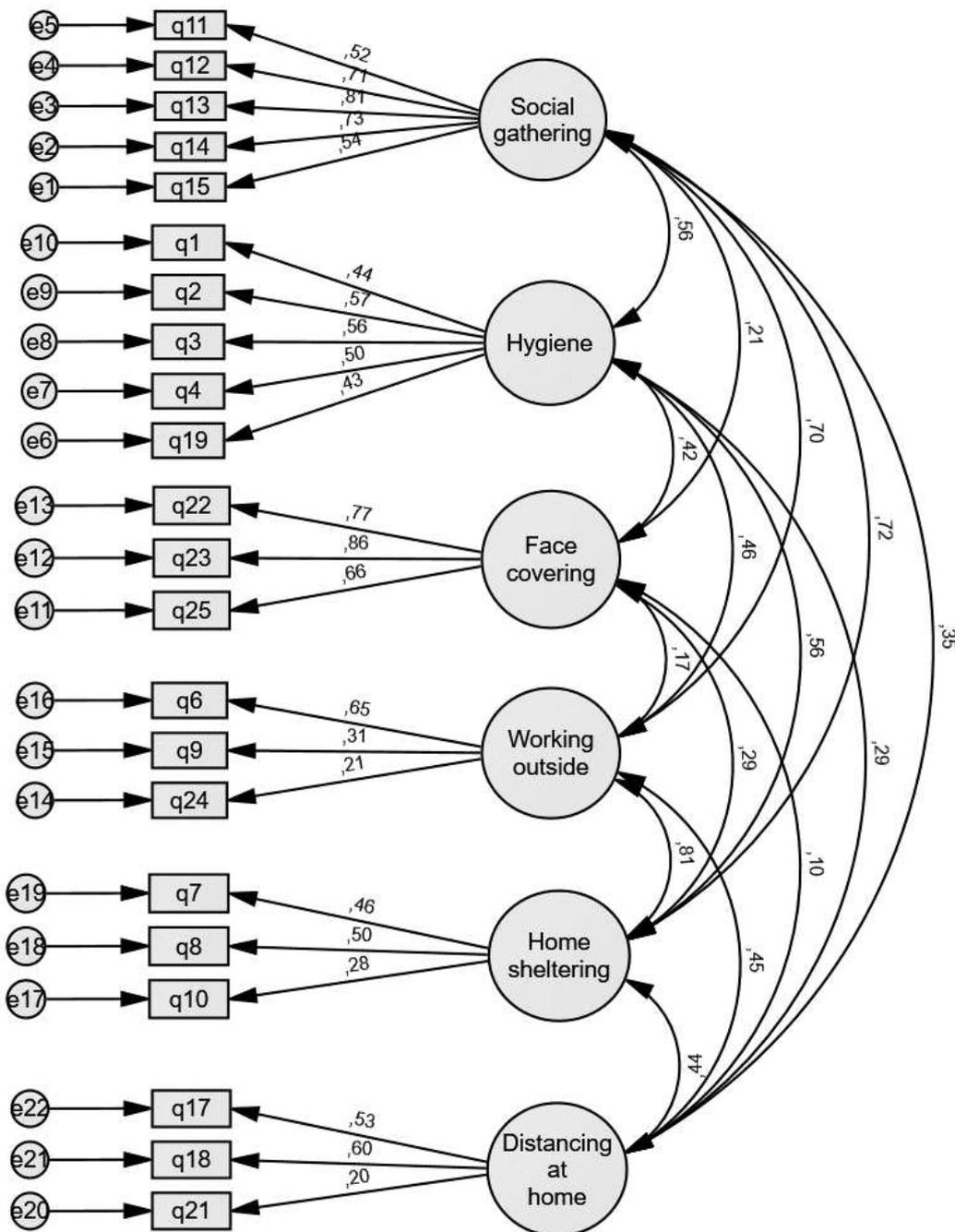


Figure 1. Confirmatory factor analysis. Only two factors were strong enough.

3.3. Partial Correlation Test

A partial correlation was run to determine the relationship between Social Gathering and Policy Stringency whilst controlling for age and gender. There was a weak, negative partial correlation between Social Gathering ($M=1.63$; $SD=1.03$) and Policy Stringency ($M=75.48$; $SD=4.41$) whilst controlling for gender ($M=1.50$; $SD=.49$) and age ($M=1.30$; $SD=.46$), which was statistically significant $r(10304) = -.083$, $N = 10308$, $p < .001$. However, zero-order correlations showed that there was already a statistically significant, weak, negative correlation between Social Gathering and Policy Stringency

($r(10306) = -.081$, $n = 10308$, $p < .001$), indicating that age and gender had very little influence in controlling for the relationship between Social Gathering and Policy Stringency. As to the relationship between Face Covering ($M=1.07$; $SD=.38$) and Policy Stringency ($M=75.48$; $SD=4.41$), it was statistically insignificant both at zero-order correlations $r(10306) = -.010$, $N = 10308$, $p = .290$ and whilst controlling for gender and age $r(10304) = -.012$, $N = 10308$, $p = .226$. In summary, Policy Stringency has no significant effect on Social Gathering and Face Covering even when controlling for age and gender.

4. Discussion

The COVID-19 pandemic has led to the introduction of a myriad of public policies aimed at controlling the outbreak of the disease and mitigating its detrimental economic reverberances. Nevertheless, the success of such measures is still a topic of discussion, as countries are still grappling with the consequences the recent pandemic has caused worldwide. In this paper, I argue that the effectiveness of public policy as well as international organizations' advice, regarding their impact on behavioral transformation, is contingent on individuals' different personality traits. This suggestion is a consequence of the evidence that policy stringency had little influence on people's health behavior in the Brazilian setting. In this vein, it is possible to surmise that governments and international organizations would benefit from adjusting their advice in response to different personality traits.

The scientific literature also supports the claim of this paper. For instance, it has been found that people presenting high levels of Conscientiousness are more likely to adopt the transmission mitigation behaviors suggested in public guidelines [52], as they tend to be inclined towards complying with governmental injunctions [32,33] and medical advice [35]. Neurotic people are hypervigilant and sensitive to threat [53,54], which might lead to compliance with the health behaviors suggested to fight COVID-19. Extraversion has been suggested to be negatively correlated with the health behaviors promoted. That is due to its subfactors of sociability and assertiveness, which has been linked to various risky health behavior [36,41] and decreased germ aversion [38].

As a backlash to the COVID-19 pandemic, a myriad of behavioral directives were introduced top-down with the goal of controlling the virus outbreak have been introduced. The point of this paper, however, is to demonstrate that public cooperation is not positively correlated with policy stringency. Governments and health authorities plea for citizens individuals to behave responsibly, by complying with these imposed behavioral guidelines and rules [55], but do not account for individuals' unique psychological characteristics [56]. As addressed in the previous paragraph, Conscientiousness, Neuroticism, and Extraversion are influential personality traits in determining whether a person will comply with public policy, but that is not all. Research has also demonstrated that Agreeableness bears an impact on someone's proclivity to abide by the policy, as disagreeable people are more likely to break rules in general [42,43]. In this vein, understanding which behaviors promote the spread of COVID-19 [4] is as important as making sense of the personality features that might relate to policy compliance.

In the midst of this, Openness seems to be the only personality trait in a grey zone. Although it has previously been associated with risky behaviors even during pandemics [28], Openness correlates also with a higher aptitude to perceive risks [31] and humankind identification [57], which might promote open individuals to act according to public guidelines as a means to comply with their civic duties. Moreover, the literature correlates Openness with liberal political attitudes [58,59]. Currently, liberals seem to be more prone to interpret the COVID-19 pandemic as a severe situation and comply with governmental advice and public policies [60,61]. Thus, higher levels of Openness seem to be overall positive rather than detrimental to policy compliance during the current pandemic.

We should bear in mind, however, that the effect sizes of personality traits in research carried out during the COVID-19 pandemic are not deterministic [52,62]. In other words, personality impacts suggest probabilistic tendencies rather than defined patterns of compliance behavior. Thus, the claim presented herein is that personality traits should be considered as an independent variable influencing the inclination of individuals to comply with COVID-19 transmission mitigation

behavioral policies since the increase of policy stringency is not an effective means to sway people's behavior. This being said, when grappling with a societal-level communication task, even comparatively reduced effects have relevant reverberances when accumulating over time and at scale [63,64]. Therefore, understanding these probabilistic propensities is of paramount importance, even if they are not deterministic in themselves.

5. Conclusions

In sum, this paper was designed to respond to the question "*Is there a positive correlation between policy stringency and transformation in health behavior?*". Based on the findings of the study (i.e., that policy stringency does not impact health behavior), I resorted to the scientific literature to look for alternative factors bearing an impact on behavior transformation. As a result, I provided a plausible suggestion that personality traits play a crucial role in people's willingness to comply with restrictive public policy during the current COVID-19 pandemic. More precisely, my claim is that individuals who present high levels of Conscientiousness, Neuroticism, Openness, and Agreeableness in addition to low levels of Extraversion might be more inclined to comply with transmission mitigation behavioral guidelines. Thus, this paper uncovers a potential shortcoming of the research conducted by the Imperial College London Big Data Analytical Unit and YouGov Plc. 2020, i.e. the absence of personality traits measurements in its survey. Moreover, it provides a useful insight for COVID-19 campaigns, i.e., local governments and international organizations would benefit more from adjusting their operations to people's psychological features than from increasing policy stringency.

There has been no shortage of articles on the COVID-19 pandemic being published since the pandemic broke out. In this sense, what sets this paper apart from the others, is its focus on what drives people to comply with the restrictive transmission mitigation behavioral guidelines. As the findings of my study revealed, increasing policy stringency does not influence people's behavior, which can be verified through the non-stop increasing number of COVID-19 cases worldwide. Thus, this study can be placed in the stream of literature defending that duty to support authorities, as well as the perceived health risks of certain behaviors, trumped the potential risk of sanctions inbuilt in the more stringent policy.

To that end, governments could, for instance, deploy strategies that enhance citizens' sense of belonging and urge to comply with civic duties, both empirical manifestations of individuals who are high in Openness [65,66]. Another solution could be to promote training focused on mitigating the harmful effects of antisocial behavior (an empirical manifestation of low levels of Agreeableness), as research has demonstrated that disagreeable people are less likely to comply with public policy [67]. Even another possibility would be to observe people's digital footprints (e.g., the data they voluntarily make available on social media such as Facebook, Twitter, and Instagram) to predict their personality traits with the help of artificial intelligence [64,68]. Such an approach would help to identify those who are least likely to adopt the transmission mitigation behavioral guidelines. In any event, these are just suggestions on how the evidence produced by this paper could positively influence future strategies to control the outbreak of the Coronavirus.

That being said, this study has certain limitations. First, although I first-handedly verified the negative correlation between policy stringency and change of health behavior regarding the COVID-19 pandemic, the use of secondary-data limited my ability to collect information on participants' personality traits. Consequently, the suggestion that health organizations and governments would benefit from focusing on people's psychological characteristics rather than increasing policy stringency is mostly underpinned solely by the (prolific and uncontroversial) scientific literature. Future research is urged to re-address my research question using the Big Five scales to assess the participants' personality traits.

Second, although the findings might be relevant to many countries, my study focused on the Brazilian setting. Countries have partnered with the World Health Organization to a great extent and consequently implemented comparable COVID-19 transmission mitigation behavioral guidelines. Nevertheless, differences have been noticed even between neighboring countries [52]. Therefore, further research should consider different contexts.

Finally, by and large, research done on change of health behavior in response to the COVID-19 pandemic demonstrates a small amount of variance in compliance with policy as a consequence of personality traits [52,62,69]. Although relevant, the Big Five personality traits should be analyzed in combination with other factors influencing compliance with COVID-19 transmission mitigation behavioral guidelines, for example, prosocial values, pathogen avoidance motives, and moral priorities of avoiding harm. Thus, I urge future research on the topic to examine the interplay between the Big Five personality traits with other factors impacting policy compliance (Allen et al., 2018).

Supplementary Materials: The following supporting information can be downloaded at the website of this paper posted on Preprints.org.

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