Iron fists and velvet gloves: Investigating the associations between the stringency of governments' responses to COVID-19, stress, and compliance

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Note

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Abstract

To tackle the spread of COVID-19, governments worldwide implemented restrictive public health behavioral measures. Whether and when these measures lead to positive or negative psychological outcomes is still debated. In this study, drawing on a large sample of individuals (N_{total}= 89,798) from forty-five nations, we investigated whether the stringency of public health measures was associated with individuals' levels of stress and compliance. Moreover, we addressed the question of how these associations may be moderated by the measures' implementation lag, nations' tolerance for unequal distribution of power, and individuals' institutional trust. Linear mixed models suggested that slower implementation of less stringent measures might be associated with higher stress and lower compliance. Such effect was especially pronounced in countries with less tolerance for inequality. Albeit significant, the moderating effect of institutional trust was very small. Results indicate the potential importance of considering the measures' implementation lag when tackling the spread of COVID-19.

Keywords: stringency index, stress, compliance, COVID-19, regulations

Introduction

The COVID-19 pandemic is one of the most severe public health crises in living memory. Governments worldwide have implemented an array of different measures, including lockdowns, social distancing, and quarantines (Fang et al., 2020; Hale et al., 2020; Leung et al., 2020). While these measures are essential to curb the spread of the virus (e.g., Flaxman et al., 2020; Brauner et al., 2020), they may also have negative psychological and behavioral implications, such as stress and lack of compliance (Brooks et al., 2020; Holmes et al., 2020; Dubey et al., 2020, Kowal et al., 2020).

The stringency of measures implemented to respond to the pandemic differs across countries, and recent research examined its social and psychological correlates (e.g., Brooks et al., 2020; Lieberoth et al., 2021; Travaglino & Moon, 2020). The findings, however, have been discordant. For instance, Fetzer et al. (2020) investigated citizens' perception of measures in fifty-eight countries. The authors found that measures perceived as more restrictive were associated with improved psychological well-being. In contrast, O'Hara et al. (2020) reported that more stringent measures were associated with stronger worries and higher depression, especially among those individuals who were more trustful of the government. These differences suggest that the relationship between stringency of the measures and psychological outcomes may be moderated by other variables. In the present study, we focus on 1) the measures' implementation lag and 2) citizens' views of the authority, either at the individual (citizens' trust in institutions) or collective (countries' power distance scores) levels.

We examine these potential moderators by drawing on two novel large-scale datasets, namely the COVIDiSTRESS global survey (Yamada et al., 2021) and the Oxford COVID-19 Government Response Tracker (OxCGRT; Hale et al., 2020). The COVIDiSTRESS dataset

includes, inter alia, measures of psychological responses such as stress, compliance, and institutional trust. The OxCRGT dataset includes estimates about the stringency of governments' responses to the pandemic and, critically for our objectives, data on when such measures have been imposed or lifted across countries. We analyzed both datasets to investigate the relationship between country-level institutional responses to the pandemic and individual-based psychological responses of stress and compliance.

How rapidly measures are implemented – what we here define as implementation lag – is critically important from a public health perspective. Flaxman et al. (2020) found the speed of governments' response to COVID-19 to be positively associated with infection mitigation. Countries that delayed the implementation of strict measures to tackle the pandemic have experienced larger numbers of fatalities and higher infection rates (see also Pei et al., 2020).

Less clear are the psychological outcomes of the variations in implementation lag. On the one hand, slower implementation of restrictive measures may result in higher rates of infections and more fatalities at the country level, subsequently leading to negative psychological outcomes including fear, stress, confusion, anger, and lower compliance (Brooks et al., 2020). On the other hand, it is also plausible that the rapid implementation of severe measures (e.g., lockdown and social distancing) may contribute to higher levels of stress and lower compliance due to the sudden changes in individuals' habits. It is thus crucial to empirically examine the role of the measures' implementation lag in moderating the relationship between measures' stringency, stress, and compliance.

Other key variables that might moderate this relationship concern individuals' views of the authority (Travaglino & Moon, 2020). In the current study, we examine both individuals' levels of trust and country-level indices of power distance. Trust in institutions is particularly

important in risky and uncertain environments, where individuals do not possess the necessary knowledge to make decisions (i.e., during a public health crisis). According to Siegrist and Cvetkovich (2000), trust in authorities managing the crisis has a direct impact on public perceptions of risks. Public perception, in turn, can determine how individuals respond to the crisis and their levels of stress. For instance, a number of studies have reported an association between low levels of institutional trust and mental health problems (Cheung & Tse, 2008; Thoresen et al. 2020). Moreover, as observed by Deurenberg-Yap et al. (2005) and Prati et al. (2011) during previous pandemics (H1N1 and SARS), there was an association between trust in institutional authorities and citizens' compliance with measures imposed during a pandemic, such that higher trust was linked to stronger compliance.

Finally, nations' overall levels of power distance may moderate the association between stringency of the measures and psychological outcomes. According to Hofstede's model of national culture (Hofstede, Hofstede, & Minkov, 2010), the dimension of power distance reflects the extent to which the less powerful members of a society accept and expect that power is distributed unequally in society. Several studies have explored how cultural factors are linked to individuals' responses to the pandemic. For example, Gelfand et al. (2020) observed that countries with tighter cultures and more efficient governments were more effective in limiting COVID-19 growth and mortality. Furthermore, Messner (2020) and Dheer et al. (2020) demonstrated that societies with higher values of power distance also had a flatter virus propagation curve. One explanation for these results is that people from such cultural contexts are more willing to comply with the instructions from the authorities, thus improving virus mitigation. In the present research we therefore examine the role of power distance in moderating the relationships between stringency of the measures and psychological outcomes.

Objective of the study

The overall objective of our study was to provide insights in why previous research has produced discordant findings when assessing the association between stringency and psychological outcomes of stress and compliance. Specifically, we hypothesized that the time to implement stringent measures in response to the pandemic (SI_{Time}), individual- (i.e., trust in government), and country-level (i.e., power distance) views of the authority would significantly moderate this association. Due to the lack of previous research, we explore the direction of the moderating effects in the analyses below.

Methods

Dataset and sample

The COVIDiSTRESS Global Survey (2020) is an international collaborative initiative that assessed people's psychological and behavioral responses to the COVID-19 outbreak across numerous countries between March 30 and May 31, 2020. Participants were recruited online, using a snowballing sampling strategy, both via social and traditional media. Participants took part in the study voluntarily and were not compensated for their participation. The survey was translated into the countries' local languages using forward-back translation. A waiver from the Ethics committee at the university in Denmark was obtained at the beginning of data collection. The Ethics committee approval was granted post-hoc on June 10, 2020. For a detailed description of the COVIDiSTRESS Global Survey, see Yamada et al. (2021).

In the present study, we utilized data collected between March 30 (early launch in Denmark, March 27) and May 3, 2020. We excluded all participants who were younger than 18, who had any missing data in relevant predictor and criterion variables, and who did not report their sex. We detected 426 outliers, which we defined as values larger than the third quartile plus 1.5 times the interquartile range, in age and number of dependents. However, removing those subjects from the subsequent analyses did not change the main conclusions about the moderating effects of the implementation lag, trust in government and PDI on the relationship between SI, stress and compliance. Thus, we included these data in the final analyses. In the final step of data cleaning we excluded all countries that had less than 100 participants after matching the aforementioned criteria (see https://osf.io/tupdx/?view_only=a9e6f30fee574aecbad3cc15096e3af7 for the raw dataset file, and https://osf.io/u34fy/?view_only=061b2627208b4173b5dbb69f1d53e69e for a detailed

cleaning procedure and reproducible R script). The final sample consisted of 89,798 respondents from 45 countries, aged between 18 and 110 (M = 39.37, SD = 13.89), of which 66,018 were women (73.52%).

Measures

Stringency Index (SI)

The OxCGRT uses a standardized set of measures to track governments' policies and interventions through time across more than 160 countries (Hale et al., 2020). It includes four composite indices (an overall government response index, a containment and health index, a stringency index, and an economic support index) that allow for between-country comparison of governments' response to the pandemic. In the present study, we used the Stringency Index (SI) as a tool to compare the severity of the implemented measures across countries. The SI is based on eight indicators of containment (school closure, workplace closure, cancelations of public events, restrictions on gatherings, closure of public transportation, stay-at-home requirements, restrictions on internal movement, international travel controls) and one health measure (public info campaigns). The SI ranges from 1 to 100, and larger values indicate greater severity of the measures. The dataset we used contained information about the country-specific SI for each day starting from January 1, 2020 to May 3, 2020. We used the dataset version from November 23rd, 2020.

Time of SI change (SI_{Time})

To examine the role of implementation lag in moderating the association between stringency, compliance, and stress, we devised a country-specific index, SI_{Time}, which we defined as the number of days it took a country to reach its maximum SI value from the day that the first restriction was implemented.

Perceived Stress Scale

Stress levels were measured using the Perceived Stress Scale (PSS-10; Cohen et al., 1983; Cohen & Williamson, 1988), which includes 10 items (four reverse-coded) measured on a 5-point Likert scale ranging from 1 (Never) to 5 (Very often). An example item is, “In the last week, how often have you felt nervous and “stressed”?”. PSS-10 has a two-factor structure (i.e., a positive and a negative factor, with the latter consisting of reversed items; Chaaya et al., 2010; Roberti et al., 2006), and is generally considered a highly reliable measure of stress (Taylor, 2015). However, in this research we calculated the composite score based on 5 items which were scalar invariant across countries (see online supplemental material – Estimating the measurement invariance of the Perceived Stress Scale). Only participants with no missing values on the 5 items were included in the analyses.

Compliance with public health measures

Compliance was measured using the item “I have done everything I could possibly do to keep physical distance to others”, constructed specifically for the COVIDiSTRESS Global Survey. (The item “I have done everything I could possibly do as an individual to reduce the spread of Coronavirus” also measured compliance in the survey, but we analyzed the first one because it was more specific and less susceptible to differences in interpretation). The item was measured on a 6-point Likert scale, ranging from 1 (Strongly disagree) to 6 (Strongly agree).

Trust in government

Trust in government was measured using the item “How much do you personally trust each of the institutions below: The parliament/government of the country I live in“, in accordance with the OECD guidelines for measuring institutional trust (OECD, 2017). (The scale

also measured trust in other bodies that were not relevant to the aim of the present study). The 11-point Likert scale ranged from 0 (not at all), to 10 (complete trust).

Power distance

The Power Distance Index (PDI) for each country was obtained from the Hofstede et al. (2010; see https://geerthofstede.com/research-and-vsm/dimension-data-matrix/). The only exception was Bosnia and Herzegovina, for which the index was estimated under the Hofstede Insights (see https://hi.hofstede-insights.com/faq). The power distance score ranges from 1 to 100. Lower scores are associated with, for instance, decentralization of power, horizontal communication, and equal rights; while higher scores are associated with, for instance, centralization of power, vertical communication, and hierarchical order without the need for any justification.

Country-level covariates

Country-level measures of gross domestic product per capita (GDP) and daily COVID-19 related deaths were included in our model to adjust for differences between countries. To measure GDP we used the International Monetary Fund nominal estimates in US dollars for 2019 (IMF, 2019). We also modeled the country-level number of daily deaths related to COVID-19 per million citizens. The data were extracted from the "Our World in Data" dataset (Roser et al., 2020), available at https://ourworldindata.org/coronavirus.

Individual-level covariates

In the present study, we also included the following individual-level covariates: participants' sex (coded as 0 for male and 1 for female), age, employment status (coded as 0 for unemployed and 1 for other statuses, i.e., students, self-employed, part-time employed, full-time employed, retired), number of dependents, and whether they or any of their close relations

(family or close friends) belonged to a high-risk group for coronavirus (e.g., pregnant women, elderly, or people with pre-existing medical conditions; coded as 0 for no-risk group and 1 for possible or certain risk).

Data preparation

Prior to analyses, we calculated the weighted average SI (SI_{wa}) for each country in the period between the March 30 (early launch in Denmark, March 27) and May 3, 2020. We used the average because, across countries, there were few changes in SI in the time period under consideration (see Figure 1). The average was weighted by the number of participants who filled out the survey on a certain date to attenuate the effect of SI change that was exhibited in some countries like South Korea, Czech Republic, and Indonesia. Analogously, we also computed the weighted average of the number of daily deaths per million citizens within a specific country. Finally, all continuous variables used as predictors were z-standardized at the between-country level (GDP, SI_{wa}, SI_{Time}, age, number of dependents, trust in government, PDI, and the number of daily deaths per million citizens). Figure 1 shows psychological stress and the stringency index (solid blue line) across time and countries.

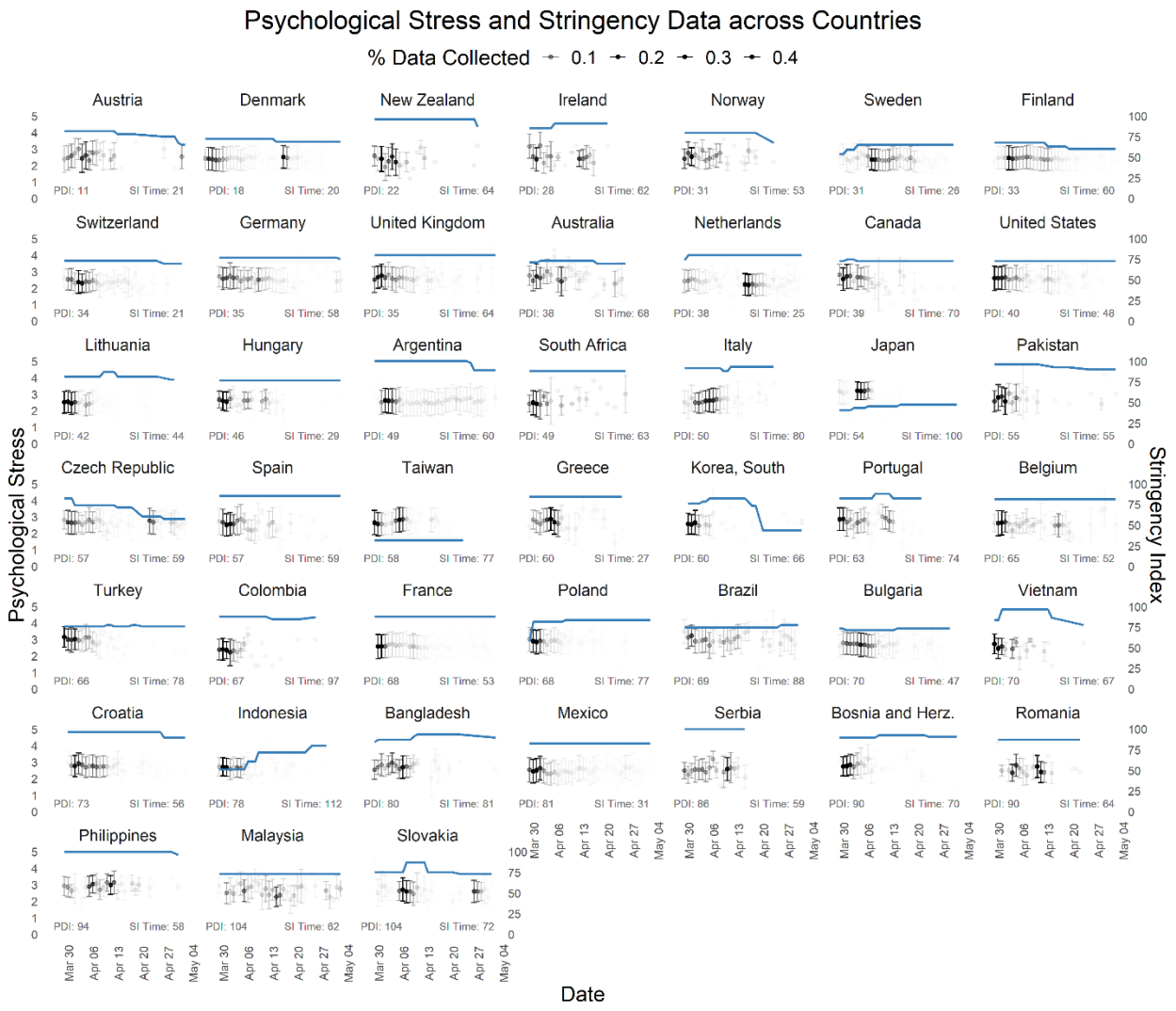

Figure 1. Psychological Stress (mean and standard deviation) across countries and time, with transparency indicating the proportion of data collected relative to each country. The blue line gives the Stringency Index, ranging from the first data point to the last for each country

Data analysis

Detailed descriptive statistics can be accessed via the .Rmd file at https://osf.io/u34fy/?view_only=061b2627208b4173b5dbb69f1d53e69e. Before analyzing differences in stress across the 45 countries, we examined the measurement invariance of the PSS-10. We obtained partial scalar invariance, with intercepts of items 1, 2, 3, 8 and 10 estimated freely for the model postulating a general factor and an orthogonal nested method factor saturating four positively phrased items (items 4, 5, 7 and 8). For subsequent cross-country

comparisons we calculated the average composite PSS score based on the invariant items only (4, 5, 6, 7, and 9). Only participants who had no missing data in these items were used in further analyses. The correlation of the reduced scalar invariant and original version of PSS average scores was 0.932. It should be noted, however, that the significance of linear mixed model effects does not replicate when using the original 10-item scale (although the pattern of results is similar). This could be due to the lack of invariance in the 10-item scale. For details about the measurement invariance testing, see Supplemental material – Estimating the measurement invariance of the Perceived Stress Scale.

Linear mixed model analyses

Our main objective was to examine whether SI_{Time}, PDI and Trust moderated the association between SI_{wa} and perceived stress and compliance during the early stages of the COVID-19 pandemic. We adjusted for the effects of the number of daily deaths per million citizens, GDP, sex, age, employment status, and belonging (or having close relations that belong) to a risk-group for COVID-19. We also investigated how PDI and trust in government further moderate these relationships by exploring two- and three-way interactions between SI_{wa}, SI_{Time}, PDI, and trust in government. To analyze the data, we fitted two linear mixed effects models using perceived stress and compliance as outcome variables. In both cases, the fixed effects were estimated for the within- and between-country predictors, whereas the random effects (RE) were estimated only for within-country predictors. For a description of how the RE structure was modeled, see Supplemental material – Modeling the random effects structure.

Software

For data manipulation and data cleaning we used R 3.6.2 (R Core Team, 2019) and the following packages: tidyverse (Wickham et al., 2019), lubridate (Grolemund & Wickham, 2011),

multicon (Sherman, 2015), and glue (Hester, 2019). For estimating metric invariance we used lavaan (Rosseel, 2012), semTools (Jorgensen, Pornprasertmanit, Schoemann & Rosseel, 2019), and ccpsyc (Karl, 2020). For LMMs we used the software Julia 1.4.2 (Bezanson, Edelman, Karpinski & Shah, 2017) and the package MixedModels (Bates et al., 2020). We used the JuliaCall (Li, 2019) package to integrate Julia with R.

Results

Perceived stress

After fitting the LMM for perceived stress, we reduced the RE structure by the number of dependents and affiliation to the risk group for COVID-19 (for details, see Supplemental material – Modeling the random effects structure). Tables 2 and 3 report results from the final model.

Table 2. The fixed effects of the final LMM using perceived stress as dependent variable

Terms - fixed effects	*b*	95% CI	*z*	Pr (>|z|)
Intercept	2.478	[2.431, 2.525]	103.552	< 0.001
SI (wa)	-0.035	[-0.092, 0.022]	-1.200	0.230
SI_{Time}	0.045	[0.006, 0.084]	2.301	0.021
PDI	-0.022	[-0.075, 0.031]	-0.790	0.430
Trust in government	-0.120	[-0.132, -0.108]	-19.282	< 0.001
Daily deaths per million (wa)	-0.008	[-0.037, 0.021]	-0.534	0.593
GDP per capita	0.008	[-0.039, 0.055]	0.336	0.737
Sex	0.176	[0.151, 0.201]	13.349	< 0.001
Age	-0.178	[-0.198, -0.158]	-17.837	< 0.001
Employment	-0.104	[-0.129, -0.079]	-7.902	< 0.001
No. of dependents	0.012	[0.008, 0.016]	5.116	< 0.001
Riskgroup	0.092	[0.082, 0.102]	17.228	< 0.001
SI (wa) x SI_{Time}	-0.092	[-0.137, -0.047]	-3.991	< 0.001
SI (wa) x PDI	0.046	[-0.005, 0.097]	1.761	0.078
SI_{Time} x PDI	-0.009	[-0.042, 0.024]	-0.511	0.609
SI (wa) x Trust in government	0.023	[0.007, 0.039]	2.988	0.003
SI_{Time} x Trust in government	0.014	[0.002, 0.026]	2.449	0.014
SI (wa) x SI_{Time} x PDI	0.054	[0.011, 0.097]	2.419	0.016
SI (wa) x SI_{Time} x Trust in government	-0.002	[-0.014, 0.010]	-0.283	0.778

Note. All variables except for Sex, Employment and Riskgroup were z-standardized.
wa - weighted average

Table 3. The random effects of the final LMM using perceived stress as dependent variable

Terms	1.	2.	3.	4.	5.
1. Intercept	0.010				
2. Trust in government	-0.063	0.001			
3. Sex	0.144	-0.569	0.005		
4. Age	0.062	0.250	-0.139	0.003	
5. Employment	-0.172	-0.023	-0.206	0.453	0.003

Note. The diagonal shows variable variances, and the non-diagonal values display correlations

As shown in Table 2, there was no significant relationship between SI_{wa} and stress across countries (b = -0.035, p = 0.230), but people seemed to experience more stress in countries where it took more time for SI_{wa} to reach its maximum (b = 0.045, p = 0.021). Moreover, there was a significant interaction between SI_{wa} and SI_{Time} (b = -0.092, $p < 0.001$). Figure 2 shows all countries grouped into tertiles depending on how quickly they reached their respective maximum stringency. The regression lines depict the association between perceived stress and SI_{wa} for a SI_{Time} value corresponding to the median of the three tertiles, keeping all other predictors at the country-averages. The fact that SI_{Time} varies with the other predictors explains why, when we fix all predictors at the country-average and only allow SI_{Time} to vary, the regression lines are not well aligned with the data points representing estimated perceived stress means for different countries. Results indicate that as the SI_{Time} increases, the relationship between SI_{wa} and perceived stress shifts from positive to negative.

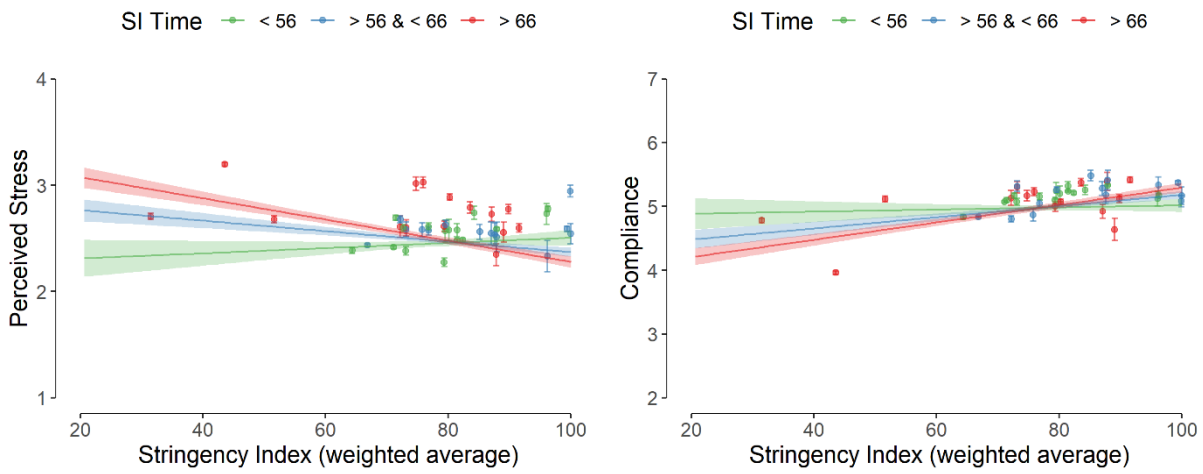

Figure 2. Shows relationship between Stringency Index and Psychological Stress (left) and Compliance (right) across Countries. Colors reflect tertiles in the time it took the countries to reach their maximum Stringency Index.

The effect of SI_{wa} and SI_{Time} on perceived stress was further moderated by PDI (b = 0.054, p = 0.016), as illustrated in Figure 3. The left panel shows the association of perceived stress with SI_{wa} and SI_{Time} for countries with low acceptance of power distance (i.e., belonging to the first tertile). For countries with lower PDI and lower SI_{Time}, the relationship between SI_{wa} and perceived stress is positive. That is, people experienced greater stress in countries where SI_{wa} was higher. On the other hand, for countries lower in PDI and with higher SI_{Time}, the relationship between SI_{wa} and stress was negative – people experienced higher stress when SI_{wa} was lower. This interaction was weaker for countries with medium PDI (middle panel). For countries higher in PDI, the time to reach the SI maximum did not modify the relationship of SI_{wa} and stress, which was generally around zero. Note the discrepancy between the raw data and the visualization of the conditional effects, which shows that the model interpolates to areas where little data exists.

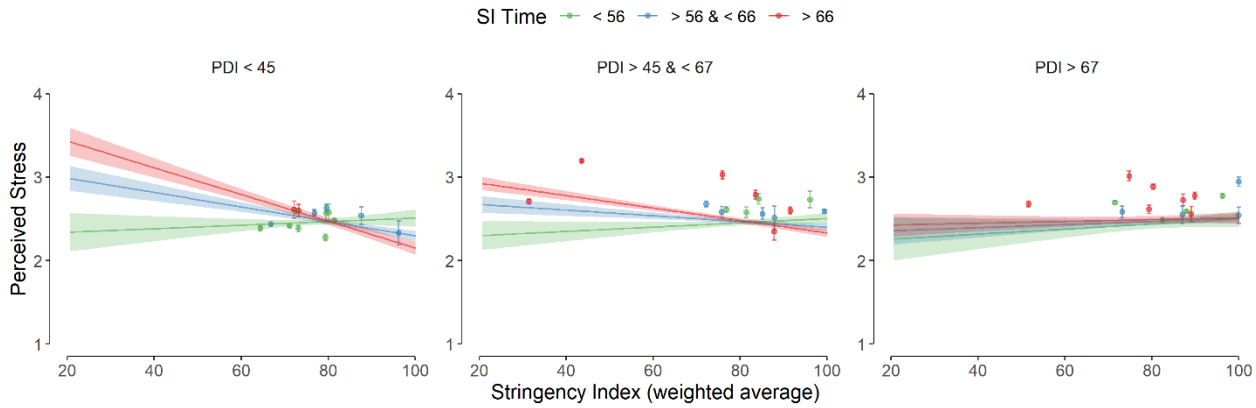

Figure 3.Relationships between Stringency Index and Perceived Stress across time it took the countries to reach their maximum Stringency Index and PDI. Colours and panels reflect tertiles in the variables

Finally, although the two-way interactions of SI_{wa} and SI_{Time} with trust in government were significant (b = 0.023, p = 0.003 and b = 0.014, p = 0.014, respectively), Figure 4 illustrates that the effects were very small (the lines for different levels of trust in government were nearly parallel).

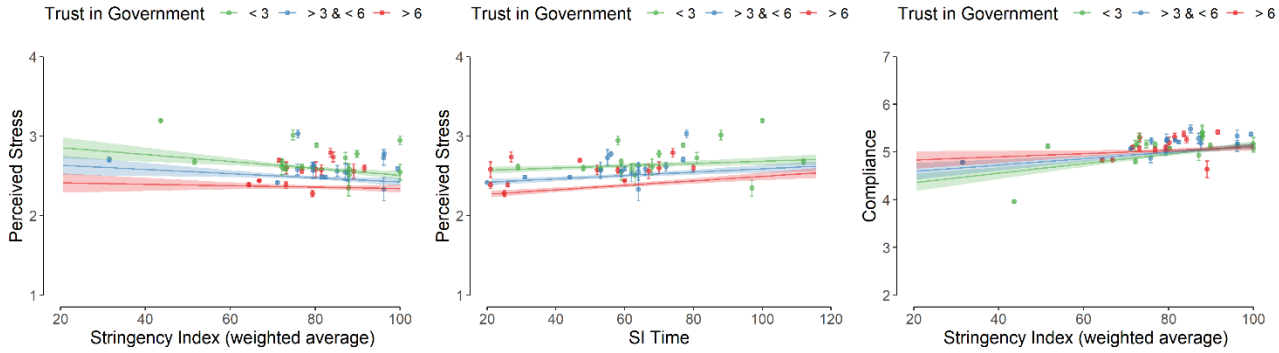

Figure 4. Left: Shows relation between Stringency Index and Perceived Stress across Trust in Government. Middle: Shows relation between SI_{Time} and Perceived Stress across Trust in Government. Right: Shows relation between Stringency Index and Compliance across Trust in Government. Colours and panels reflect tertiles in the variables.

Looking at the other fixed effects, we observed that PDI, weighted average of the number of daily deaths per million, and GDPpC were not significantly associated with perceived stress. On the other hand, the results suggested that women (b = 0.176, p < 0.001), younger people (b = -0.178, p < 0.001), the unemployed (b = -0.104, p < 0.001), those affiliated with a risk group for

COVID-19 (b = 0.092, p < 0.001), those who have more dependents (b = 0.012, p < 0.001), and people who have less trust in government (b = -0.120, p < 0.001) generally experienced higher levels of stress during the COVID-19 pandemic. Interestingly, the RE structure indicated that there was little between-country variance in these predictors.

Compliance

The initial LMM RE structure for compliance was reduced by the affiliation to the risk group for COVID-19 RE component (for details, see Supplemental material – Modeling the random effects structure). The final model is presented in Table 4 and 5.

Table 4. The fixed effects of the final LMM using compliance as dependent variable

Terms - fixed effects	*b*	95% CI	*z*	Pr (>|z|)
Intercept	4.966	[4.892, 5.040]	130.392	< 0.001
SI (wa)	0.090	[0.012, 0.168]	2.223	0.026
SI_{Time}	-0.012	[-0.067, 0.043]	-0.418	0.676
PDI	0.060	[-0.016, 0.136]	1.551	0.121
Trust in government	0.052	[0.030, 0.074]	4.778	< 0.001
Daily deaths per million (wa)	0.033	[-0.010, 0.076]	1.477	0.140
GDP per capita	-0.028	[-0.097, 0.041]	-0.797	0.425
Sex	0.207	[0.183, 0.231]	16.550	< 0.001
Age	0.093	[0.073, 0.113]	9.202	< 0.001
Employment	-0.083	[-0.112, -0.054]	-5.597	< 0.001
No. of dependents	0.009	[-0.003, 0.021]	1.563	0.118
Riskgroup	0.103	[0.087, 0.119]	13.609	< 0.001
SI (wa) x SI_{Time}	0.089	[0.026, 0.152]	2.798	0.005
SI (wa) x PDI	-0.103	[-0.177, -0.029]	-2.715	0.007
SI_{Time} x PDI	-0.012	[-0.059, 0.035]	-0.516	0.606
SI (wa) x Trust in government	-0.044	[-0.071, -0.017]	-3.098	0.002
SI_{Time} x Trust in government	-0.008	[-0.028, 0.012]	-0.763	0.445
SI (wa) x SI_{Time} x PDI	-0.020	[-0.083, 0.043]	-0.625	0.532
SI (wa) x SI_{Time} x Trust in government	0.017	[-0.005, 0.039]	1.519	0.129

Note. All variables except for Sex, Employment and Riskgroup were z-standardized.
wa - weighted average

Table 5. The random effects of the final LMM using compliance as dependent variable

Terms	1.	2.	3.	4.	5.	6.
1. Intercept	0.033					
2. Trust in government	-0.062	0.003				
3. Sex	-0.732	0.144	0.003			
4. Age	-0.030	-0.258	-0.076	0.003		
5. Employment	0.233	0.347	-0.220	-0.629	0.002	
6. No. of dependents	0.261	-0.170	-0.020	0.504	0.125	0.001

Note. The diagonal shows variable variances, and the non-diagonal values display correlations

The analysis suggests that SI_{wa} is positively related to compliance (b = 0.090, p = 0.026), that is, people in countries with higher SI_{wa} comply more. Moreover, this relationship is moderated by SI_{Time}, PDI, and trust in government.

The interaction of SI_{wa} and SI_{Time} (b = 0.089, p = 0.005) indicates that as SI_{Time} increases, the relationship between SI_{wa} and compliance becomes more strongly positive (see Figure 2, right panel). In countries where the SI maximum was reached slowly, SI_{wa} was more strongly associated with compliance than in countries where SI maximum was reached quickly.

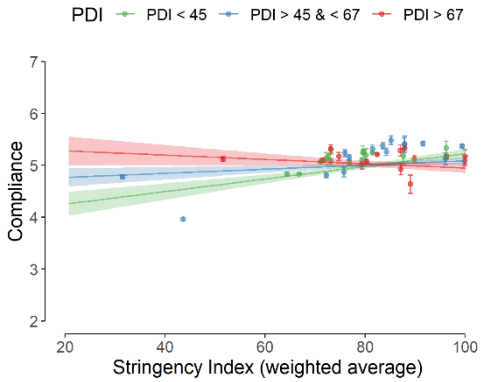

Figure 5. Shows relation between Stringency Index and Compliance moderated by PDI. Colours reflect tertiles in PDI.

The relationship between SI_{wa} and compliance was moderated by PDI (b = -0.103, p = 0.007). As Figure 5 shows, in countries with low PDI (operationalized here as being in the first tertile) there

is a positive relationship between SI_{wa} and compliance; as PDI increases, the association comes closer to zero and turns slightly negative in high PDI countries (operationalized here as being in the third tertile). The visualization of the conditional effect again illustrates how the model interpolates to areas where little data was observed.

Finally, although the interaction of SI_{wa} and trust in government (b = -0.044, p = 0.002) suggests that the relationship between SI_{wa} and compliance becomes less positive as the trust in government rises, the effect was small (see Figure 4, right panel).

The fixed effects of individual-level predictors suggested that women (b = 0.207, $p < 0.001$), older people (b = 0.093, $p < 0.001$), the unemployed (b = -0.083, $p < 0.001$), people affiliated with a risk group for COVID-19 (b = 0.103, $p < 0.001$), and people who have greater trust in government (b = 0.052, $p < 0.001$) tended to comply more. Similarly to the model for perceived stress, the RE variances indicated little between-country variation in the mentioned fixed effects. On the other hand, the country-level predictors, PDI, weighted average of daily deaths per million and GDP were not associated with compliance.

Discussion

Research examining relationships between stringency of public health measures, stress and compliance has so far yielded contrasting results. Some findings suggest that higher stringency may have positive implications for individuals' psychological well-being (Fetzer et al., 2020), whereas other results emphasize the negative consequences of strict governments' responses (O'Hara et al.,2020). In this article, we addressed this discordance and extended previous research by examining the moderating roles of SI_{Time}, and individuals' relationship with the authority at the individual (trust in government) and country-level (power distance).

Stringency and stress

Our findings support the idea that SI_{Time} moderates the relationship between SI_{wa} and stress. When the implementation of restrictive measures was faster, higher stringency measures were associated with greater stress. However, as the time needed to reach the maximum SI levels increased, the relationship changed – stress was predicted to be higher SI was lower. Because we adjusted for the influence of the number of recorded deaths due to COVID-19, we can rule out the possibility that it is only the severity of the situation that is associated with increased stress, rather than the stringency and implementation lag of the public health measures.

Our results imply that people may experience greater stress in two scenarios: when the implementation of restrictive measures is weak and slow and strong and rapid, with the former combination being associated with the most negative implications (see Figure 2). Several factors can make changes in life circumstances stressful (Cohen, Murphy, & Prather, 2019), for instance - the need to adapt to the new situation, the amplified perception of threat or harm, situational demands that exceed individuals' resources or interruptions to one's goals. All such factors may be intensified by an increase in the stringency and speed of governments' responses, even when

there is an objective need for the government to step in and protect their citizens. However, our research suggests that lack of change/action in such situations could be associated with higher levels of stress. People may also feel more stressed when they observe that, after a longer time, their government has not done enough to protect them from the immediate threat, while other governments have done much more to secure their citizens.

Interestingly, these findings are more pronounced in countries with lower PDI versus countries with higher PDI. Citizens from low-PDI countries tend to question the authorities more, are less emotionally distanced from each other, and are more interdependent (Hofstede, Hofstede, & Minkov, 2010). Thus, low-PDI countries governments' actions have a stronger effect on their citizens. On the other hand, in high-PDI countries, people are more accepting of hierarchical structures and differences. In such cultures, changing restrictive measures in a rapid or more balanced timing is not related to stress levels.

SI and compliance

Results also indicate that SI's relationship with compliance becomes more positive as the time taken to reach the maximum SI level increases. Thus, lowest compliance is predicted for situations when weaker measures are implemented more slowly. This may happen because such combination of circumstances signals the lack of government action.

Similar to the results concerning stress, our model predicted that citizens in lower-PDI cultures are also more responsive to their country's instructions and are more likely to comply when the SI_{wa} is higher. Conversely, the model predicts that high-PDI cultures maintain a nearly constant level of compliance irrespective of the SI_{Time} and SI_{wa}. This suggests that while people in low-PDI countries adjust their behaviors in accordance with government's instructions,

citizens in high-PDI countries are not as susceptible to government's measures, but still attempt to comply.

Interestingly, although trust in government significantly moderated the association between SI and stress/compliance, the effects were small. Because there are countries where the measures were proposed by civil protection bodies and not by the government, it is possible that the trust towards such institutions might be a stronger moderator of the association.

Limitations

There are a number of limitations to our study that need to be considered. First, our research was exploratory in nature. As other large COVID-19-related psychological datasets focused on stress and compliance become available, they may be used to try to replicate our results on diverse samples. Moreover, we analyzed observational data, and, thus, no causal inferences can be made. Although we have adjusted for a set of relevant variables, including GDP per capita and proportion of deaths due to COVID-19, countries also differ on a myriad of variables that we have not measured. Furthermore, while our dataset comprises a large number of individuals, the number of countries is limited; this means that we have less power to detect associations regarding country-level predictors. As a case in point, our statistical model linearly extrapolated to areas where little data was observed. Moreover, some of the measures we used comprised only a single item, which may have resulted in lower reliability, while others (e.g., PSS) were used in a shorter form to achieve measurement invariance across countries. It should be noted that SI_{Time} is a country-specific measure, and so we could not quantify the lag of the implementation of stringent measures in an objective manner.

In addition, we used countries' SI averages. However, because SI changes across time, examining the relationship of SI, stress and compliance within countries could yield more

detailed insights. To examine such association, data covering a substantially longer period of time would be needed.

Conclusion

Taken together, our model shows that, in the midst of COVID-crisis, failing to take institutional action for a longer period of time may be associated with stronger negative psychological outcomes – such that individuals report lower compliance and higher levels of stress. More positive psychological outcomes appear to be associated with gradual implementation of more stringent measures. However, replication and further research is required to support our preliminary findings about the potential significance of measurement implementation lag.

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