**Increased Risk Perception, Distress Intolerance and Health Anxiety in
Stricter Lockdowns: Self-Control as a Key Protective Factor in Early
Response to the COVID-19 Pandemic**

Christoph Lindner^{1,2*}, Ibolya Kotta³, Eszter Eniko Marschalko³, Kinga Szabó³, Kinga Kalcza-Janosi³,
& Jan Retelsdorf¹

¹*University of Hamburg, Hamburg, Germany*

²*Leibniz Institute for Science and Mathematics Education (IPN), Germany*

³*Babeş-Bolyai University, Cluj-Napoca, Romania*

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*Corresponding author. Address: University of Hamburg (UHH), Faculty of Education, Educational Psychology. Von-Melle-Park 8; 20146 Hamburg, Germany. Phone: +49 40 42838-3184; E-mail: christoph.lindner@uni-hamburg.de ORCID ID: <https://orcid.org/0000-0001-5688-3146>.

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Abstract

Studies provide evidence that distress, (health) anxiety and depressive symptoms were high during the first weeks of COVID-19 lockdown restrictions, decreasing over time, possibly due to individuals' protective psychological factors. Relations between different lockdown restrictions, mental health issues, and protective factors need to be explored, since even small lockdown effects might increase the risk of future mental health issues. We merged objective lockdown stringency data with individual data ($N = 1,001$) to examine differences in lockdown effects in strict lockdown (Romania) and mild lockdown (Hungary) conditions between March and May 2020 on stressors and mental health symptoms, taking protective factors into account. The stricter lockdown in Romania revealed higher levels of perceived risk of infection, distress intolerance, and COVID-19 health anxiety. Protective psychological factors were not affected by the lockdown measures. Surpassing psychological flexibility and resilient coping, self-control proved to be the most promising protective factor. It is recommended that future research merge objective data with study data to investigate the effects of different COVID-19 lockdown measures on mental health and protective factors. Policy decisions should consider lockdown-dependent consequences of mental health issues. Intervention programs are suggested to mitigate mental health issues and to strengthen peoples' protective psychological factors.

Keywords: COVID-19, lockdown measures, stringency index, self-control, health anxiety, negative automatic thoughts

1. Introduction

In an early stage of the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) pandemic, several countries reacted with strict lockdown and quarantine policies, causing higher levels of mental health symptoms. A higher risk of increased anxiety and depressive symptoms was reported for younger, female, lower-educated, lower-earning persons, or persons living alone (Batterham et al., 2021; Fancourt et al., 2021; Saunders, et al., 2021). Prati and Mancini (2021) in their recent meta-analysis found small average effects of lockdowns on anxiety and depression, with heterogeneous effect sizes that might be ascribable to differences in lockdowns, samples and study designs. Furthermore, the role of mediating variables such as the perceived risk of a SARS-Cov-2 infection, or distress intolerance, remains unclear. Initial studies show that the coronavirus disease 2019 (COVID-19) lockdowns are associated with health-related anxiety (e.g., Mohd et al., 2021) and negative automatic thoughts (e.g., Rosebrock & David, 2021) due to increased distress (intolerance) or perceived risk of getting infected. Gaining deeper insights into these relations is important because COVID-19-dependent health anxiety and negative automatic thoughts might be prerequisites for illness anxiety disorder, dysthymia or depression (Beck, 1963; Chatterjee et al., 2020; Scarella et al., 2016).

During the lockdowns between March and May 2020 however, the initially high levels of anxiety and depressive symptoms decreased rapidly (Batterham et al., 2021; Fancourt et al., 2021; Saunders et al., 2021), indicating that protective psychological factors may help with adapting to the circumstances (cf. Prati & Mancini, 2021). There are three possible protective psychological factors for distress and mental health symptoms during the COVID-19 restrictions, which are correlated but differentiable. First, psychological flexibility: the ability to adapt and to respond effectively to fluctuating situational demands by reconfiguring mental resources (Kashdan & Rottenberg, 2010), predicted higher levels of well-being and

lower COVID-19-related distress, anxiety (Chong et al., 2021; Dawson & Golijani-Moghaddam, 2020) and problems due to social isolation (Smith et al., 2020).

Second, resilient coping, the ability to rebound from and adapt to stressors (Dyer & McGuinness, 1996) allows people to recover from or adjust to misfortune or change (Mish, 1996). Resilience is associated with lower levels of depression, anxiety (Song et al., 2021), and COVID-19-related distress (Osimo et al., 2021). High resilience was also related to (mental) health-promoting behaviors during the lockdown, such as outdoor activities, exercising, sleeping better or praying, and to higher levels of social support (Killgore, 2020). Third, trait self-control—the capacity to override or change inner responses, to interrupt undesired behavioral tendencies, and to refrain from acting on them (Tangney et al., 2004)—can play an important role during the COVID-19 pandemic. Trait self-control correlates positively with tolerance for COVID-19 generated distress (Schnell & Krampe, 2020) and with goal-directed behavior regardless of COVID-19 related uncertainties (Kokkoris & Stavrova, 2021). Self-control moderates the relationship between perceived severity of COVID-19 illness and mental health issues (Li et al., 2020), is related to COVID-19 health-protective behavior (e.g., social distancing; Wolff et al., 2020), and to supporting governmental regulations during lockdown (Kukowski et al., 2021).

Responding to these preliminary suggestions of psychological factors being beneficial during the COVID-19 pandemic, Prati and Mancini (2021) call for studies investigating in more detail the interplay between different levels of lockdown measures, induced stressors, early mental health issues, and personal characteristics. In addition to studying differences in perceived risk of SARS-CoV-2 infection, distress intolerance, COVID-19 health anxiety and negative thoughts under different lockdown conditions, in this study we aimed to examine associations between these conditions and protective psychological factors.

To investigate such relations Salanti et al. (2021) suggest merging individual data with the geographical and temporal characteristics of COVID-19 lockdowns provided in the

Oxford Coronavirus Government Response Tracker (OxCGRT) dataset (Roser et al., 2020). For our research the *Stringency Index* (SI) included in OxCGRT is most important. This daily measure contains nine governmental response indicators for each country, such as school and workplace closures, stay-at-home requirements or information campaigns (for details see Hale et al., 2021) and ranges from 0 (no restrictions) to 100 (maximum restrictions).

1.1 Strict vs. mild lockdown measures in Romania vs. Hungary and their psychological consequences

To investigate differences in lockdown measures, induced psychological distress, mental health symptoms, and protective factors, we studied the neighboring countries Hungary and Romania which differed in the stringency of their lockdown measures (cf. Plümper & Neumayer, 2020).

After the state of emergency call on March 11 2020 in Hungary (Binder et al., 2020), relatively mild personal restrictions followed until the end of May, whereas Romania (state of emergency call on March 16 2020) introduced a strict nationwide lockdown on March 24 for the same period (cf. Dascalu, 2020). In Hungary small social events were permitted and people were encouraged to leave their homes only to purchase essential goods, to use medical services, for work or caregiving tasks. In Romania people were obliged to stay home and a signed statement was mandatory for people leaving their homes. The military supported the police in enforcing these restrictions (cf. Mantu, 2020). The average SI between March and end of May 2020 indicates a significantly higher level of lockdown restrictions in Romania than in the European Union and Hungary (see Figure 1). It must be noted that Romania had more COVID-19 cases per million and a higher positive rate and reproduction rate than Hungary, whereas there were no differences in COVID-19 deaths per million and tests per thousand (details in supplement S1).

Figure 1. Description of the governmental stringency of lockdown conditions during the first months of the COVID-19 pandemic in Hungary and Romania.

Note. The dots and triangles represent the distribution of each individual's SI score (not the P_{SIW}), referring to the day of participation in the present study, and show that all participants had experienced more or less country-specific governmental restrictions for at least one month before participation.

To date the impact of the different lockdown measures in these countries on mental health issues is unknown. Prior to the pandemic, Hungary's prevalence rates for anxiety disorders, dysthymia, and depression in 2019 were higher than Romania's for those under 70 and for women (IHME, 2020). Following Prati and Mancini (2021), even small effects of COVID-19 lockdown measures on anxiety and depressive symptoms might cause significant public mental health problems. Thus, insights into the relations between COVID-19 restrictions, induced stressors, mental health issues and personal characteristics are needed to develop mental health intervention programs (e.g., Gruber et al., 2020).

Following the fear appeal theory of public health (Witte & Allen, 2000), we assume that one major psychological function of governmental restrictions is increasing people's

perception of risk of getting infected, so that they engage in preventive behaviors (Rogers, 1975; Tagini et al., 2021) such as social distancing or hand washing (e.g., Alegria et al., 2021). In addition, lockdown-dependent perceived risk of infection might be a stressor (Prati & Mancini, 2021) inducing depressive symptoms (Kim et al., 2021) and health anxiety (Mohd et al., 2021). Strict lockdown measures might also induce distress due to challenges such as working at home (Prati & Mancini, 2021) or parenting (Romero et al., 2020). Lockdown-dependent distress can exceed individuals' distress tolerance threshold—their capacity to withstand aversive emotional distress (Simons & Gaher, 2005). During this pandemic, distress intolerance has been positively related to higher risks for anxiety and depression (Liu et al., 2020). Fergus et al. (2015) assume that distress intolerance is particularly associated with health anxiety.

High levels of health anxiety may lead to severe misinterpretations of bodily sensations. Regarding COVID-19, coughing for example may be interpreted as a sign of infection, in turn further increasing general anxiety (Asmundson & Taylor, 2020b). Rosebrock and David (2021) call for research addressing catastrophic thoughts about COVID-19 and negative automatic self-related thoughts (Beck, 1963) as prerequisites for depression.

In respect of Hungary there is some evidence of higher levels of perceived risk of infection, emotional distress, and mental health symptoms during the first COVID-19 wave, between March and May 2020 (Lábadi et al., 2021; Marschalko et al., 2021), with women and younger people the most affected (Szabo et al., 2020). Comparable research in Romania is scarce. Ștefănuț et al. (2021) found Romanian females showing higher levels of depression, anxiety and distress. Mental health in Romania may have been affected more negatively than Hungary due to the stricter lockdown.

1.2 The present research

First, we investigated whether stricter lockdown measures in the early COVID-19 pandemic in Romania induced higher levels of perceived risk of a SARS-CoV-2 infection, distress intolerance, COVID-19 health anxiety and negative automatic thoughts, compared to Hungary, assuming that a stricter lockdown has a stronger negative impact on these variables.

Second, we explored the relation of the different lockdown measures to protective psychological factors (psychological flexibility, resilient coping, and trait self-control), perceived risk of a SARS-CoV-2 infection, distress intolerance, COVID-19 health anxiety, and negative automatic thoughts. Particularly, we tested whether protective factors prevent negative effects on risk perception, distress intolerance, negative automatic thoughts, and COVID-19 health anxiety.

2. Methods

2.1 Participants

The sample comprised $N = 1,001$ (almost exclusively female) adults from Hungary and Romania with a university degree (see Table 1 for a detailed description). None of the participants had been diagnosed with COVID-19. The study protocol was approved by the Ethics Committee of the University of Babeş-Bolyai University (RO). Informed consent was obtained from all participants. Data were collected online between April 15 and May 31 2020 using Google Forms. The study was promoted on social media platforms. Since states of emergency were called on March 11 in Hungary and March 16 in Romania, followed by a national lockdown in Romania on March 24 2020, participants had been confronted with governmental restrictions for at least one month before participation.

To estimate lockdown-dependent treatment effects, we applied Propensity Score Matching (PSM), controlling for possible confounds (e.g., socio-demographics, see below).

The matched sample comprised $N = 406$ ($n_{\text{Hungary}} = 203$ and $n_{\text{Romania}} = 203$) participants. We used G*Power 3.1.9.7 (Faul et al., 2007) for a sensitivity analysis of the paired t-tests applied, comparing outcomes between the matched samples. Given $\alpha = .05$ and $N = 406$ participants, a targeted power of .95 would reveal small COVID-19 lockdown effects ($d_z = 0.179$) as reported by Prati and Mancini (2021) on anxiety and depression.

2.2 Instruments

English items were translated into Hungarian and Romanian by bilingual speakers. Cronbach's alpha was acceptable to excellent for all used scales ($.82 \leq \alpha_{\text{Hungary}} \leq .95$; $.76 \leq \alpha_{\text{Romania}} \leq .94$). For all measures higher scores indicate a higher level of the variable. Item examples and—if applicable—the corresponding Likert scales are presented in supplement S2.

Socio-demographics and COVID-19-Related Variables. All variables were assessed using single-item measures (see Table 1).

COVID-19 Knowledge. COVID-19 knowledge was assessed using seven items (adapted from Cheng and Ng, 2006) including three correct and four incorrect true-false statements.

Official COVID-19 Dataset. We used official governmental data provided on a daily basis between March 11 (State of Emergency call in Hungary) and May 31 2020 in the *World in Data “Coronavirus Pandemic (COVID-19)”* dataset (Roser et al., 2020) and in the *OxCGRT* dataset (Hale et al., 2021). We calculated individualized indices P_{SIW} for the stringency conditions between March 11 and the day of participation (mean stringency index values), weighted by the derivative of the natural logarithmic function (for details see supplement S3). The weight implies that P_{SIW} scores are higher, the earlier that persons participated in the present study, since the first weeks in lockdown had the strongest negative impact on mental health issues (Fancourt et al., 2021).

Perceived Risk of SARS-CoV-2 Infection. Seven items measured risk perception based on Brug et al. (2004), Commodari (2017) and Ibuka et al. (2010). Two items each assessed perceived likelihood of infection with SARS-CoV-2 and susceptibility to disease, three items the perceived severity of the disease.

Distress Intolerance. Seven items of the frustration discomfort (Harrington, 2005) subscale ‘emotional intolerance’ measured intolerance of emotional distress.

COVID-19 Health Anxiety. The 6-item brief version of the *Health Anxiety Inventory* (Salkovskis et al., 2002) was adapted to assess COVID-19 health anxiety, including questions concerning psychological thoughts and reactions to bodily sensations. Every item comprised four statements and was scored according to the choice of statements between 1 and 4 indicating level of health anxiety.

Negative Automatic Thoughts. The Automatic Thoughts Questionnaire (Netemeyer et al., 2002) contains 15 statements describing negative-dysfunctional self-related automatic thoughts.

Trait Self-Control. Trait self-control was measured with the 13 items of the *Brief Self-Control Scale* (Tangney et al., 2004).

Psychological Flexibility. Twenty items from Ben-Itzhak et al. (2014) were used to measure psychological flexibility.

Resilient Coping. The *Brief Resilient Coping Scale* is a 4-item measure assessing resilient coping (Sinclair & Wallston, 2004).

2.3 Statistical procedures

We applied PSM to investigate research question 1. PSM is commonly used in public health research to estimate causal treatment effects, adjusting for confounds in observational data when randomization is not possible (for an overview see He et al., 2016). In our study,

we wanted to investigate marginal treatment effects (Rosenbaum, 2005), the propensity score being defined as the probability of treatment assignment (mild lockdown vs. strict lockdown) as predicted by all observed baseline covariates, shown in Table 1, where are also presented tests of the imbalance in baseline characteristics before PSM, using two-sample t-tests for continuous variables, Chi-squared tests for categorical variables, and the standardized mean differences (SMD, equivalent to Cohen's d) of any covariate before and after PSM, indicating the standardized bias between both countries (cf. Austin, 2011a). SMD should be reduced to a minimum, at least to $|\text{SMD}| < 0.25$ after PSM (Cochran & Rubin, 1973; Rubin, 2001). Paired t-tests were then applied to test differences in the outcomes after PSM (Austin, 2011b). A detailed description of how PSM was implemented in the current study is presented in supplement S4.

To investigate the second research question, we applied path modeling using *Mplus* 8.6 (Muthén & Muthén, 2017) with the full sample (before PSM). All variables were modeled as manifest variables, and relations between all variables were allowed to vary freely. Thus, a saturated model with $df = 0$ and no fit statistics resulted. Since we were interested in indirect effects, we used the maximum likelihood estimator with bootstrapping (20,000 iterations) and confidence intervals (Preacher & Selig, 2012). We tested direct, indirect and total effects. Correlations between variables at the same levels (predictors, mediators, outcomes) were allowed. We included age, gender, employment, COVID-19 knowledge, received SARS-CoV-2 test, infected acquaintances and country as covariates in the model, due to substantial correlations with the outcomes (see Table 2). There were no missing data.

Table 2. Bivariate Correlations for Study Variables.

Variable	<i>M</i>	<i>SD</i>	01	02	03	04	05	06	07	08	09	10	11	12	13
(01) COVID-19 knowledge	6.17	0.80	—												
(02) Already tested (1 = yes)	0.02	0.14	.08	—											
(03) Cases acquaintances (1 = yes)	0.21	0.41	.08	.10	—										
(04) Deaths acquaintances (1 = yes)	0.03	0.16	.03	-.02	.19	—									
(05) Perceived risk of infection	3.13	0.88	.22	.11	.14	.02	—								
(06) Distress intolerance	2.52	1.00	.03	.08	.02	.04	.15	—							
(07) COVID-19 health anxiety	1.81	0.47	.18	.08	.10	.03	.58	.29	—						
(08) Negative automatic thoughts	1.84	0.79	.03	.05	.00	.00	.19	.64	.29	—					
(09) Trait self-control	3.51	0.60	-.08	.00	.07	.08	-.15	-.37	-.14	-.42	—				
(10) Psychological flexibility	4.89	0.64	-.02	.00	.06	-.02	.02	-.26	-.18	-.32	.19	—			
(11) Resilient coping	3.83	0.70	.01	.02	.01	-.07	.03	-.25	-.16	-.38	.34	.60	—		
(12) Pers. stringency index (<i>P_{SIW}</i>)	1.45	0.20	.13	.04	-.02	.04	.22	.09	.25	.12	.01	-.03	-.07	—	
(13) Age	40.93	11.14	-.09	-.08	.13	.06	-.08	-.09	-.16	-.10	-.01	.11	.01	-.11	—
(14) Gender (1 = female)	0.90	0.31	-.01	.05	.07	.00	.05	.09	.06	.08	-.01	.06	-.03	-.01	-.01

Note. Bold indicates $p < .05$.

3. Results

3.1 Governmental restrictions and the early COVID-19 situation in Hungary and Romania

Referring to the World of Data COVID-19 dataset (Roser et al., 2020), the mean values of the SI for Hungary, Romania and the European Union differed significantly from zero: $F(2, 243) = 21.250, p \leq .001, \eta^2_p = .146$. As shown in Figure 1, the mean level of governmental restrictions was significantly higher for Romania than for Hungary ($M_{\text{Diff}} = 8.90, SE = 1.44, p \leq .001, 95\text{-CI} [5.58, 12.36]$) and for the European Union ($M_{\text{Diff}} = 6.84, SE = 1.44, p \leq .001, 95\text{-CI} [3.45, 10.23]$). This result indicates that, compared to the Hungarian government, the Romanian government responded more strictly to the COVID-19 outbreak.

3.1.1 Research question 1: Differences between Hungary and Romania

Before-PSM significant differences and $|SMD| > 0.25$ between Hungarian and Romanian participants were found in gender, age, number of children, COVID-19 knowledge, COVID-19 cases and deaths among participants' acquaintances, self-control, psychological flexibility and resilient coping, and in the propensity score (Table 1 on the right). After PSM, SMD was reduced to a minimum ($0.00 \leq SMD \leq 0.16$) and the overall balance test (Hansen & Bowers, 2008) indicates optimal balancing ($\chi^2(15) = 5.285, p = .989$) between both groups' baseline characteristics (Table 1, on the left). Thus, differences in the outcomes are not due to these confounding variables. Detailed results of the PSM are presented in supplement S4.

Table 1. *Sample Characteristics, Baseline Measures and Standardized Mean Differences before (right; N = 1,001) and after (left; N = 406) Propensity Score Matching, and Treatment Effects on COVID-19 Dependent Variables (bottom).*

		Sample N = 406 after PSM			Sample N = 1001 before PSM			
Characteristics	Category	Hungary (n = 203)	Romania (n = 203)		Hungary (n = 761)	Romania (n = 240)		
		<i>F_n</i> (%); <i>M</i> (<i>SD</i>)	<i>F_n</i> (%); <i>M</i> (<i>SD</i>)	<i>SMD</i>	<i>F_n</i> (%); <i>M</i> (<i>SD</i>)	<i>F_n</i> (%); <i>M</i> (<i>SD</i>)	<i>SMD</i>	<i>P</i>
Gender	Male	21 (10.3 %)	21 (10.3 %)	0.00	54 (7.1 %)	31 (12.9 %)	0.20	.020
	Female	182 (89.7 %)	182 (89.7 %)	0.00	707 (92.9 %)	209 (87.1 %)	-0.20	
Age [range]		41.41 (10.02) [23 – 67]	40.44 (12.16) [19 – 79]	-0.09	50.43 (11.01) [23 – 81]	38.35 (12.46) [19 – 79]	-1.03	<.001
Residency	Village	27 (13.3 %)	34 (16.7 %)	0.10	151 (19.8 %)	39 (16.3 %)	-0.08	.251
	City	176 (86.7 %)	169 (83.3 %)	-0.10	610 (80.2 %)	201 (83.8 %)	0.10	
	Household size	2.78 (1.29)	2.74 (1.10)	-0.03	2.61 (1.29)	2.71 (1.10)	0.08	
	Nr. of children	1.01 (1.09)	0.92 (1.03)	-0.08	1.60 (1.21)	0.79 (1.00)	-0.73	
Education	University degree	203 (100 %)	203 (100 %)	0.00	761 (100 %)	240 (100 %)	0.00	1.000
Occupation	Unemployed	27 (13.3 %)	29 (14.3 %)	0.03	154 (20.2 %)	32 (13.3 %)	-0.18	.102
	Employee	119 (58.6 %)	119 (58.6 %)	0.00	407 (53.5 %)	144 (60.0 %)	0.12	
	Manager	50 (24.6 %)	44 (21.7 %)	-0.07	163 (21.4 %)	51 (21.3 %)	0.00	
	CEO	7 (3.4 %)	11 (5.4 %)	0.10	37 (4.9 %)	13 (5.4 %)	0.02	
Finance	Bank loan	57 (28.1 %)	62 (30.5 %)	0.05	236 (31.0 %)	66 (27.5 %)	-0.07	.301
COVID-19	COVID - Knowledge (Max. = 7 points)	6.11 (0.87)	6.24 (0.73)	0.16	6.13 (0.83)	6.27 (0.72)	0.18	.022
	Already tested	2 (1.0 %)	6 (3.0 %)	0.14	31 (4.1 %)	6 (2.5 %)	-0.08	.989
	Diagnosed	0 (0.0 %)	0 (0.0 %)	0.00	0 (0.0 %)	0 (0.0 %)	0.00	1.000
	Cases acquaintances	41 (20.2 %)	43 (21.2 %)	0.02	99 (13.0 %)	58 (24.2 %)	0.29	<.001
	Deaths acquaintances	5 (2.5 %)	5 (2.5 %)	0.00	13 (1.7 %)	8 (3.3 %)	0.10	.038

Protective factors	Trait self-control	3.50 (0.60)	3.52 (0.60)	0.03	3.72 (0.62)	3.46 (0.62)	-0.42	<.001
	Psych. flexibility	4.90 (0.63)	4.88 (0.65)	-0.03	4.96 (0.65)	4.85 (0.66)	-0.17	.033
	Resilient coping	3.83 (0.64)	3.82 (0.74)	-0.01	3.99 (0.66)	3.76 (0.76)	-0.32	<.001
Propensity score (logit)		0.35 (0.19)	0.36 (0.20)	0.05	0.18 (0.16)	0.42 (0.23)	1.21	<.001

		Hungary (<i>n</i> = 203)	Romania (<i>n</i> = 203)			
		<i>M</i> (<i>SD</i>)	<i>M</i> (<i>SD</i>)	<i>t</i>	<i>p</i>	<i>Cohen's d_z</i>
Treatment check	P _{SIW}	1.32 (0.14)	1.57 (0.18)	-14.975	< .001	1.061
				<i>t</i>	<i>p</i>	<i>Cohen's d_z</i>
Dependent variables	Per. risk of infection	3.03 (0.87)	3.22 (0.88)	-2.052	.042	0.148
	Distress intolerance	2.41 (1.00)	2.64 (0.99)	-2.564	.011	0.180
	COVID Health anxiety	1.74 (0.48)	1.87 (0.44)	-2.810	.005	0.204
	Neg. automatic thoughts	1.79 (0.79)	1.90 (0.80)	-1.357	.117	0.095

Note. SMD = Standardized mean differences before and after PSM. P_{SIW} = Personalized Stringency Index score weighted.

The significant treatment check (Table 1, at the bottom) indicates that the Romanian governmental COVID-19 restrictions between March 11 and the day of participation were stricter compared to Hungary ($d_z = 1.061$). The Romanian participants showed significantly higher levels of perceived risk of SARS-CoV-2 infection, distress intolerance and COVID-19 health anxiety than those from Hungary. No significant differences were found regarding negative automatic thoughts. Correlations between all COVID-19 related variables and the protective psychological factors are presented in Table 2.

3.1.2 Research question 2: Lockdown stringency conditions and protective factors as predictors of COVID-19 related outcome variables

The results of our path model are presented in Figure 2 and Table 3. Perceived risk of infection showed a strong relation to COVID-19 health anxiety but no significant relation to negative automatic thoughts. The latter were most strongly predicted by distress intolerance, while a weak relation was found between distress intolerance and health anxiety. The relation between P_{SIW} and health anxiety was stronger than between P_{SIW} and automatic thoughts. P_{SIW} directly predicted perceived risk of infection but not distress intolerance. Perceived risk of infection mediated the relations between P_{SIW} and health anxiety. No significant direct effect between P_{SIW} and any of the protective psychological factors was found.

Figure 2. Results of the path model investigating effects of personalized stringency conditions (P_{SIW}) and protective psychological factors on COVID-19 related outcome variables: Direct effects.

For the protective factors, weak negative relations were found between resilient coping and distress intolerance, automatic thoughts, and health anxiety. The indirect effects of resilient coping via distress intolerance to automatic thoughts and health anxiety were also significant. Higher levels of psychological flexibility were weakly and negatively related to distress intolerance, health anxiety and automatic thoughts. Also, weak, significant indirect effects of psychological flexibility on negative thoughts and health anxiety were found via distress intolerance. Resilient coping and psychological flexibility were both not significantly related to risk perception. Trait self-control turned out to be the most promising protective factor in the early COVID-19 pandemic in Hungary and Romania, evidenced by the strongest negative direct effects on automatic thoughts, perceived risk of infection, and distress intolerance. We found significant indirect effects of self-control on health anxiety via perceived risk of infection and on automatic thoughts and health anxiety via distress intolerance.

Table 3. Direct, Indirect, and Total Effects of the Personalized Stringency Index (P_{SIW}) and Psychological Protective Factors on COVID-19-related Outcomes.

[illegible]

	[-.171, -.018]												[-.171, -.018]
NAT	-.118*** [-.180, -.055]	—	—	—	—	—	—	—	—	—	.003 [.000, .012]	-.048* [-.088, -.010]	-.163*** [-.238, -.086]
CHA	-.101** [-.171, -.032]	—	—	—	—	—	—	—	—	—	.036 [-.005, .078]	-.018* [-.035, -.004]	-.083 [-.172, .005]
Trait self-control to outcome													
PROI	-.126*** [-.192, -.061]	—	—	—	—	—	—	—	—	—	—	—	-.126*** [-.192, -.061]
DI	-.387*** [-.445, -.326]	—	—	—	—	—	—	—	—	—	—	—	-.387*** [-.445, -.326]
NAT	-.179*** [-.235, -.123]	—	—	—	—	—	—	—	—	—	-.006 [-.014, .000]	-.194*** [-.232, -.161]	-.379*** [-.437, -.320]
CHA	.059 [-.001, .116]	—	—	—	—	—	—	—	—	—	-.062*** [-.096, -.030]	-.071*** [-.098, -.046]	-.074* [-.141, -.007]
Psychological flexibility to outcome													
PROI	-.048 [-.124, .029]	—	—	—	—	—	—	—	—	—	—	—	-.048 [-.124, .029]
DI	-.078* [-.145, -.011]	—	—	—	—	—	—	—	—	—	—	—	-.078* [-.145, -.011]
NAT	-.066* [-.122, -.010]	—	—	—	—	—	—	—	—	—	-.002 [-.009, .001]	-.039* [-.074, -.006]	-.107** [-.178, -.039]
CHA	-.089** [-.151, -.026]	—	—	—	—	—	—	—	—	—	-.023 [-.060, .014]	-.014* [-.029, -.003]	-.126** [-.201, -.050]

Note. *** $p < .001$, ** $p < .01$, * $p < .05$. RC = Resilient coping; TSC = Trait self-control; PF = Psychological flexibility; PROI = Perceived risk of infection; DI = Distress intolerance; NAT = Negative automatic thoughts; CHA = COVID-19 health anxiety.

4. Discussion

The present study investigated psychological effects of the SARS-CoV-2 pandemic, considering different lockdown characteristics. Our first aim was to examine whether stricter lockdown measures in Romania led to higher levels of distress and mental health symptoms than did the milder restrictions in Hungary. Second, we investigated the relations between perceived risk of a SARS-CoV-2 infection, distress intolerance, health anxiety, negative automatic thoughts and the protective psychological factors psychological flexibility, resilient coping and trait self-control. To investigate whether these variables were differentially affected by contrasting lockdown measure stringency levels we followed Salanti et al. (2021) in merging temporal and geographical information about lockdown restrictions with our individual data. The P_{SIW} scores proved to be a promising measure for investigating lockdown-dependent effects. Our sample comprised almost exclusively adult women, who were the most negatively affected by lockdown measures in the early stage of the COVID-19 pandemic (Batterham et al., 2021; Fancourt et al., 2021; Saunders et al., 2021).

Investigating the first research question we applied PSM, controlling for personal characteristics and COVID-19 related variables as possible confounds. As hypothesized, Romanian participants living under stricter lockdown showed higher levels of risk perception, distress intolerance and COVID-19 health anxiety than did Hungarians. No significant differences were found in negative automatic thoughts. Considering that prior to COVID-19 both countries' prevalence rates were higher for anxiety than for depression (IHME, 2020), this might be due to a higher vulnerability to anxiety in both countries. Interestingly, prior to the pandemic prevalence rates for anxiety, dysthymia and depression were lower in Romania than Hungary, whereas we found higher levels of distress intolerance, perceived risk and health anxiety in Romania during the pandemic.

Although differences in perceived risk, distress intolerance and health anxiety were small, in the long run this might result in significant public health problems (cf. Prati &

Mancini, 2021). Our results raise the question whether stricter lockdowns might impact people's rational decision making and preventive behaviors. As discussed by Asmundson and Taylor (2020a, 2020b) high levels of perceived risk of infection and health anxiety might lead to avoiding medical assistance, due to the risk of contagion at medical facilities. Alternatively, they might visit multiple facilities to ensure their health. Thus, rigorous controls on compliance with lockdown rules in Romania may have fostered inadequate behaviors in people with COVID-19 symptoms. Mild lockdown measures in Hungary, however, may not have led people to follow adequate preventive behaviors (Tagini et al., 2021). The different outcomes in the two countries highlight the need for well-balanced governmental lockdown strategies and effective risk communication in the context of pandemic outbreaks.

Applying path modeling to the second research question provided support for the fear appeal theory (Witte & Allen, 2000): Higher levels of lockdown measures, indicated by P_{SIW} , were related to higher levels of perceived risk of SARS-CoV-2 infection. Both variables had detrimental effects on health anxiety. As discussed above, adequate policy responses to future pandemic outbreaks should consider relations between personal restrictions, risk perception and health anxiety.

Negative automatic thoughts were most strongly related with distress intolerance, weakly with P_{SIW} and not at all with risk perception. Stricter lockdown restrictions had no direct relation to people's tolerance for emotional distress. This needs to be discussed in detail, since we found higher distress intolerance in Romanians than Hungarians in the PSM sample. One possible explanation may be the different statistical models used. In the path model the variance of distress intolerance was partly explainable by protective factors, which might have impeded the direct effect of P_{SIW} on distress intolerance. Moreover, we assume that COVID-19 side effects such as worries about losing one's job or negative attitudes toward the governmental restrictions might have negatively affected distress intolerance and

mental health issues (cf. Prati & Mancini, 2021). Further research may provide insights into these relations.

To the best of our knowledge, our study is the first providing empirical evidence that three key protective factors were not affected by lockdown measures. Previous research has shown psychological flexibility and resilient coping as preventive of negative automatic thoughts, health anxiety, and distress intolerance, but not risk perception (Osimo et al., 2021; Ruiz & Odriozola-González, 2016; Ruiz et al., 2017; Song et al., 2021).

The detrimental effects of lockdown measures were most strongly mitigated by trait self-control. Self-control was related to lower risk perception of infection. Inhibiting impulses and regulating one's own behavior and thoughts might foster social distancing (cf. Wolff et al., 2020), reduce exposure to risky situations, and reduce COVID-19 health anxiety. Self-controlled individuals seem to have greater capacity for emotional tolerance, indicating that they are less prone to emotional distress, which in turn helps them regulate negative automatic thoughts and prevent health anxiety. In line with previous findings, self-controlled individuals seem to use adequate strategies to deal with COVID-19-related stressors (Schnell & Krampe, 2020), and perceived lower risk of infection may be due to higher levels of goal-orientation (Kokkoris & Stavrova, 2021) and engagement in health-protective behavior.

Summarized, all protective factors were beneficial during the early COVID-19 pandemic. Thus, we suggest implementing public intervention programs to enhance people's resilience, psychological flexibility, and self-control. For example, Joyce et al. (2018) found that interventions combining cognitive behavioral therapy and mindfulness techniques are best to enhance resilience. Masuda and Tully (2012) emphasize psychological flexibility in psychological interventions for anxiety, depressions, distress or somatization. Promoting psychological flexibility enables people to shift their focus from symptoms to underlying processes, increasing their mental health (Østergaard et al., 2020). Self-control training

(Frieese et al., 2017) may also help. Yang et al. (2018) found self-control training reduced depressive symptoms.

Against these new insights into relations between lockdown measures and psychological outcomes, we have to discuss some limitations. First, our sample comprised non-COVID-19-diagnosed participants and almost exclusively adult women. Thus, our results may only be generalized to this group. Since various studies suggest that women in particular suffered from mental health issues during the early lockdown restrictions (Batterham et al., 2021; Fancourt et al., 2021; Saunders et al., 2021), our results may be valid for the most relevant population.

Second, PSM always neglects unobserved covariates (Austin et al., 2005). Here, negative attitudes toward lockdown measures that may have negative effects on mental health might have been of particular interest (Prati & Mancini, 2021). However, during the early COVID-19 pandemic public approval of lockdown measures was high across countries (YouGov, 2020). Moreover, differences in cultures and economies may affect the results. Nevertheless, considering lower pre-pandemic prevalence rates for anxiety and depression in Romania than in Hungary (IHME, 2020), Romania's higher levels of risk perception, health anxiety, and distress intolerance may have been affected by stricter lockdown measures.

Third, missing information about participants' previous mental health diagnoses prevents ruling out whether the country differences are solely a function of earlier mental health issues. Nor do we know whether mental health symptoms increased during the lockdown compared to the baseline before COVID-19. Future research drawing on longitudinal studies can bring more insights into the effects of different lockdown strategies. We have tried to compensate for these weaknesses by controlling for confounds in all of our analyses, to provide initial results on relations between lockdown measures, psychological outcomes and protectors.

5. Conclusion

To the best of our knowledge, this is the first study merging objective stringency index data with individual data to investigate effects of different lockdown measures on stressors, mental health symptoms, and protective psychological factors in the early COVID-19 pandemic. We compared two neighboring countries with very different lockdown measures. Whereas Romania had one of the strictest lockdowns in the European Union, Hungary's government was much less so. We found that stricter lockdown measures increased people's perceived risk of SARS-CoV-2 infection, distress intolerance and health anxiety, while the protective psychological factors of psychological flexibility, resilient coping and self-control were not affected during the first lockdown in 2020. Furthermore, our study gained deeper insights into the relations between restriction levels, protective factors, stressors, health anxiety and negative automatic thoughts.

Policy decisions about the severity of lockdowns in pandemics should take two major issues into account. First, strict lockdowns might increase perceived risk of infection and health anxiety in the population. This might affect people's behavior respective to medical support. On the one hand, medical facilities may be visited too little. Being infected with SARS-CoV-2 but not going to the doctor increases the risk of infecting others. On the other hand, multiple doctors might be consulted, increasing strain on health care resources. Second, mild lockdowns may lead to the population's perception of risk being low, resulting in inadequate COVID-19 health-protective behavior. Thus, policy decisions about the stringency of lockdown measures need to consider the tradeoff between infections, deaths and healthcare capacities but also inductions on the population's experiences and behavior. Finally, our results suggest the need to implement intervention programs to mitigate negative effects of COVID-19 lockdowns on mental health, and to strengthen protective psychological factors.

Considering specific COVID-19 pandemic characteristics and the stringency of containment policies to investigate lockdown measure effects on changes in mental health (see also Salanti et al., 2021) is a viable option for future research.

Appendix

Supplementary online material.

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