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Predicting Behavioral Intentions to Prevent or Mitigate COVID-19: A Cross-Cultural Meta-Analysis of Attitudes, Norms, and Perceived Behavioral Control Effects

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Abstract

We examined the effectiveness of attitudes, subjective norms, and perceived behavioral control (PBC) of the theory of planned behavior on COVID-19 relevant behavioral intentions and behaviors. We conducted a meta-analysis of 335 effect sizes from 83 samples across 31 countries ($N = 68{,}592$). We found strongest effects for PBC, but contrary to previous research also moderately strong effects of subjective norms. Focusing on systematic context effects: (a) norm–behavior associations at individual level were strengthened if population norms were stronger; (b) collectivism strengthened norm effects in line with cultural theories, but also attitude and PBC associations, suggesting that COVID-relevant behaviors show collective action properties; (c) in line with cultural theory, tightness–looseness strengthened normative effects on behaviors; and (d) contrary to post-modernization theory, national wealth weakened attitude and PBC associations. These analyses provide new theoretical and practical insights into behavioral dynamics during an acute public health crisis.

Keywords

COVID-19, theory of planned behavior, norms, culture

The current COVID-19 pandemic raises important challenges for global health. Even with the rapid deployment of vaccines, populations need to agree to become vaccinated, and there is a need for continued behavioral restrictions until sufficient individuals have been vaccinated to ensure herd immunity at a population level. Hence, behavioral interventions remain essential for limiting the spread of COVID-19 (Centers for Disease Control and Prevention, 2020). Unfortunately, in the current social and political climate, there are controversies around these guidelines, and research-guided information on what variables may improve adherence is essential. One of the most widely accepted theories for predicting behavioral intentions and behaviors in the social and health domain is the theory of planned behavior (TPB; Ajzen, 1991). It postulates that behavioral intentions are determined by one's evaluation of a behavior as positive (attitude), one's perception that people one cares about want one to do the action (subjective norm), as well as the belief that the one is able to perform the behavior (perceived behavioral control [PBC]).

Among these predictors, the subjective norm component is typically the weakest predictor of behavioral intentions compared with attitudes and PBC (Armitage & Conner, 2001; McDermott et al., 2015; Nardi et al., 2019; Paquin & Keating, 2017) and subsequently, some researchers even dropped norms from their analyses (Armitage & Conner, 2001; Cooke et al., 2016). Based on these patterns, the recommendation would be to focus on attitudes and PBC when aiming to improve COVID-19 preventive behaviors. Norm effects may be weaker compared to attitudes and PBC under ordinary circumstances when examining self-oriented health. Nevertheless, this pattern is likely to differ for events (such as the COVID-19 pandemic) that require individual action to avert collective harm (Czeisler et al., 2020; Prosser et al., 2020; Templeton et al., 2020). The pandemic is creating a markedly different context in which health behaviors are only partially self-oriented and individual behavior has wider-reaching collective effects (Allcott et al., 2020; Courtney et al., 2020). Subjective norms may play a stronger role for intentions and behavior compared to other behavioral contexts. A first important question in this context is therefore to test how well the theory and the individual components work in statistically predicting behavioral intentions and self-reported behaviors in a pandemic context, in which the

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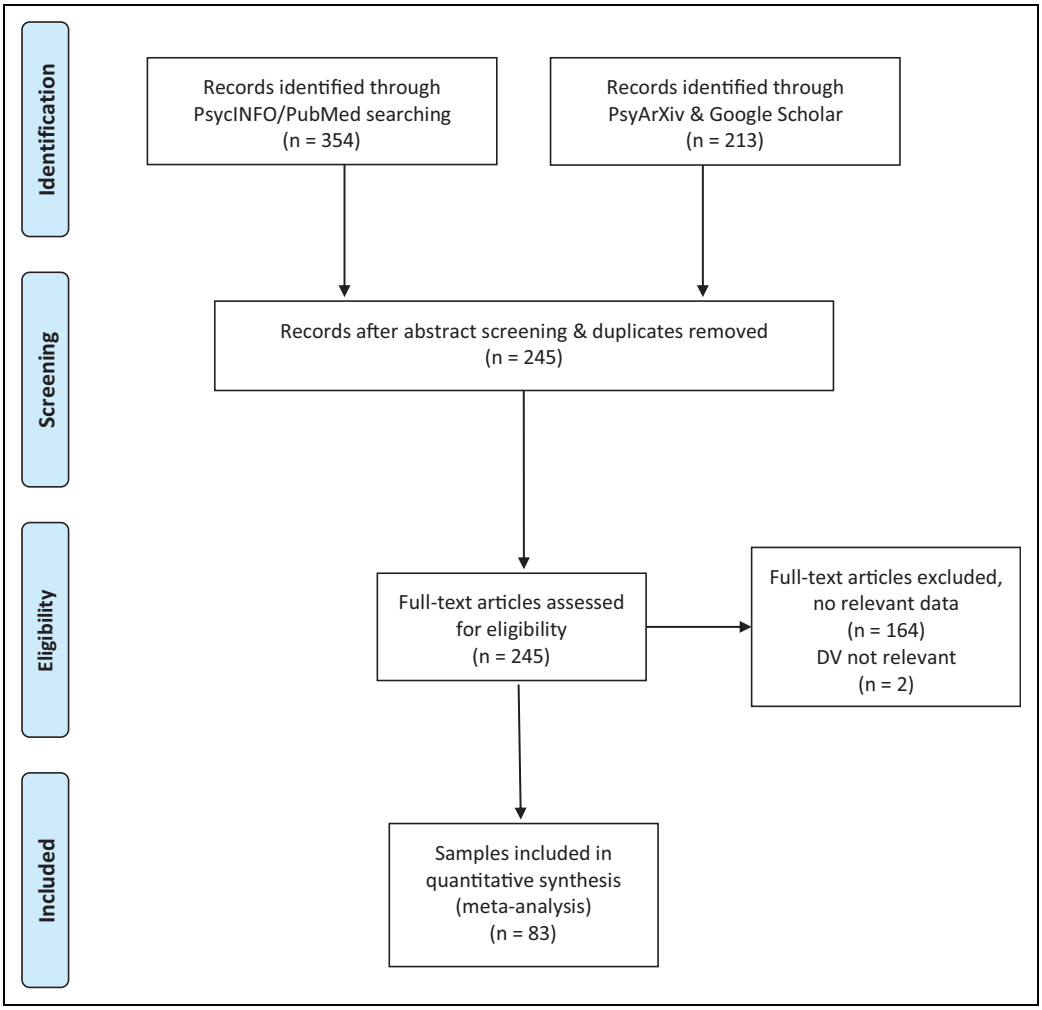

Figure 1. PRISMA flow chart of study inclusion.

individual action is partially motivated to protect the most vulnerable in society.

Second, context effects are likely to play an important role for the effectiveness of TPB. To what extent and under which circumstances should decision makers aim to influence attitudes, norms, or PBC in their campaigns to contain the virus? The differential success rate of controlling the spread of COVID-19 across different societies raises important questions about contextual factors, including cultural and economic variables, which may affect the effectiveness of behavioral interventions (Biddlestone et al., 2020; Gelfand et al., 2021). Much of this research is based on cross-cultural work which was conducted outside acute crisis situations. An important question is whether macro-level predictors operate in the same way during crises conditions, which significantly interrupted normal life and have the potential to shift behavioral dynamics. We test whether (a) TPB varies in its effectiveness across cultures and (b) standard economic and cultural predictions can be used to account for systematic variability in TPB performance. Addressing these questions is important from both theoretical and applied perspectives, given the prominence that TPB has in the social and health psychology literature.

We focus on variables at community and societal level. To examine the weaker norm effects noted in previous TPB studies, we test the effect of perceived subjective norms at the population level on the relative strength of the correlations between individual-level perceived subjective norms and behavior. There are marked differences in the adoption and overall social approval rates of specific behavioral actions such as mask wearing and physical distancing within and across communities (Dryhurst et al., 2020; Hou et al., 2020; Morita et al., 2020). Such differences in norm levels might modulate effects of individual-level variables. In line with the situated dynamics framework (Leung & Morris, 2015; M. W. Morris et al., 2015), we propose that subjective norm effects on behavior should be strengthened if there is higher subjective norm endorsement at the community level. Higher levels of perceived social approval of behaviors are likely to reinforce the effect of subjective norms held by individuals. We are the first to explicitly test this cross-level interaction between population and

Table 1. Country-Level Descriptives.

Location	Norm	Tightness	GDP	Individualism	$N_{Studies}$	$N_{Samples}$	$N_{Effects}$	$N_{Observations}$
AUS	0.68	−0.49	53,469	1.19	3	4	21	1,141
BGD	0.79	NA	4,964	−0.97	2	2	12	719
BRA	0.62	−1.02	15,300	0.06	3	3	11	3,042
CAN	NA	−0.44	51,669	1.3	1	1	3	1,003
CHN	0.71	0.41	16,830	−0.62	9	10	26	17,084
DEU	0.83	0.18	56,278	1.27	3	3	6	2,916
ESP	0.31	−0.60	42,195	0.71	2	2	4	1,578
FRA	NA	−0.06	49,435	1.4	1	1	1	940
GBR	0.86	−0.23	48,698	1.44	3	11	83	2,084
HKG	0.81	−0.06	62,496	−0.57	1	3	9	300
IDN	0.90	1.02	12,335	−0.93	9	9	22	2,470
IRN	0.72	0.75	12,938	−0.45	1	1	6	1,718
ISR	0.77	−1.12	42,146	0.38	1	1	3	398
ITA	0.56	−0.07	44,248	0.72	1	1	3	2,398
KAZ	0.65	0.27	27,518	−1.38	1	1	3	181
KOR	0.33	0.78	43,143	−0.47	6	7	19	2,258
MYS	NA	1.13	29,620	−0.71	2	2	5	1,957
NLD	0.74	−1.24	59,554	1.55	2	3	5	924
NZL	0.76	−0.91	43,953	1.53	1	1	4	1,032
PAK	0.79	2.06	4,898	−1.03	3	3	9	1,099
PHL	0.75	NA	9,302	−0.56	2	2	6	983
POL	NA	−0.51	34,431	−0.01	2	2	2	1,299
ROU	0.71	NA	32,297	−0.6	1	1	3	556
RUS	NA	−1.20	29,181	−0.46	1	1	1	986
SAU	0.65	1.30	49,040	0.06	1	1	3	324
SGP	0.46	1.04	101,649	−0.67	1	1	4	1,023
SRB	0.53	NA	19,495	−0.18	1	1	2	300
SWE	NA	0.65	55,820	1.66	1	1	1	922
UAE	NA	0.98	70,089	−0.17	1	1	3	1,880
USA	0.75	−0.23	65,298	1.02	14	18	68	11,472
VNM	NA	0.77	8,397	−0.43	3	3	7	1,036

Note. GDP = gross domestic product.

individual-level norms. Because norm effects are typically stronger for publicly visible behaviors compared to private behavior or intentions that are inaccessible to observers (Chiu et al., 2010; Fischer, 2006; Yamagishi et al., 2008), we speculate that this cross-level norm effect may be stronger for behaviors compared to intentions.

At the societal level, individualism–collectivism theory (Triandis, 1995) predicts variability in the relative importance self-oriented cognitions and efficacy beliefs compared to social influence dynamics such as subjective norms which represent "the perceived social pressure to perform or not to perform the behavior" (Ajzen, 1991, p. 188). Groups take on greater importance in more collectivistic societies; hence, individuals are likely to pay more attention to normative information when deciding on actions instead of paying attention to their own impulses and inclinations (Cialdini et al., 1999). In societies with higher levels of individualism, personal attitudes and beliefs take on greater priority for guiding behavior. Therefore, cultural theory predicts that behavior is guided by greater reliance on norms in collectivistic societies, and personal attitudes and beliefs (including PBC) are more important in higher individualism contexts (Fischer et al., 2009; Riemer et al., 2014; Triandis, 1995). These predictions have been broadly supported in TPB studies (Hooft & Jong, 2009; Morren & Grinstein, 2016) as well as in studies examining the influence of individualism–collectivism on attitudes and normative concepts more broadly (Abrams et al., 1998; Eom et al., 2016; Fischer, 2017; Fischer et al., 2009; Fischer & Mansell, 2009; Smith, 2017).

One important caveat speaking against this hypothesis is that behavioral intentions and behavior in the current pandemic environments are strongly associated with collection action to protect the more vulnerable within society. This collective focus is likely to strengthen the role of collectivism for behavioral responses (Biddlestone et al., 2020), leading to a possible reversal of patterns typically associated with attitudes and beliefs, and therefore, higher levels of collectivism may strengthen attitude and PBC effects to the extent that individual-level cognitions and beliefs are aligned with the larger goals of the collective (Biddlestone et al., 2020; Riemer et al., 2014). We test these contrasting predictions.

A second important cultural dimension is tightness–looseness (Gelfand et al., 2011, 2021). In *loose* cultures, there is a wide range of acceptable behaviors, and behavioral

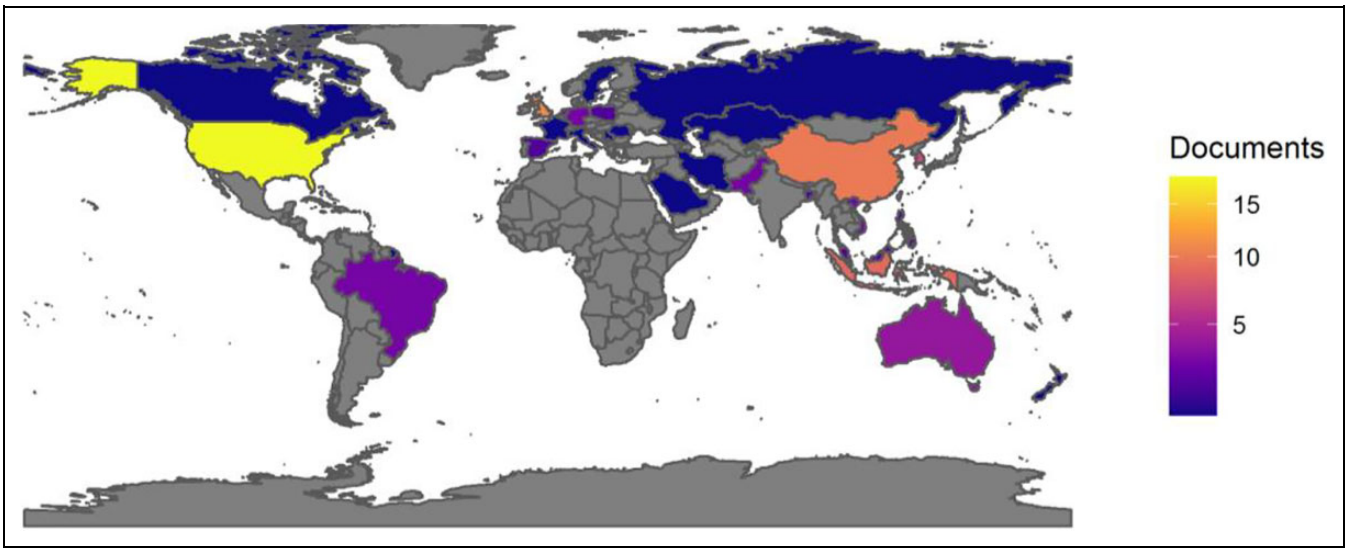

Figure 2. Geographical distribution of samples included.

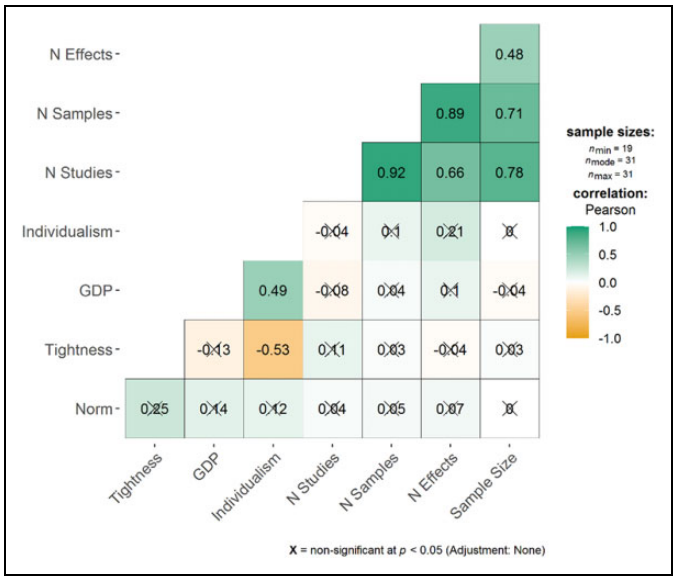

Figure 3. Correlation between the variables included in the meta-analysis and study characteristics.

transgressions of weakly delineated and enforced norms are tolerated. In contrast, *tight* cultures restrict behavioral expression, allow expression of only a narrow range of behaviors, and norm violations are not tolerated. Tight cultures may fare better in situation of crises because tight norms facilitate smooth social organization (Roos et al., 2015). Indeed, a number of studies (Cao et al., 2020; Gelfand et al., 2021) demonstrated that tight societies were better able to contain the spread of the COVID-19 virus. Following these observations, we predict that in societies with greater tightness, subjective norms are a stronger predictor of both behavioral intentions and actual behavior. Our study is the first to explicitly test the effect of tightness–looseness on subjective norms within the TPB framework.

Finally, we examine economic predictors. The post-modernization hypothesis (Inglehart, 1997) proposes that individuals with sufficient economic resources to secure their living are more likely and feel more capable to express their thoughts and desires because they have the financial means to do so. In contrast, in more economically deprived conditions, individuals rely more on social support networks for survival, which in turn strengthens normative effects compared to attitudinal effects on behavioral decisions (Fischer, 2017; Welzel, 2013). Broadly in line with these predictions, previous research has demonstrated that personal attitudes and beliefs were stronger predictors of behavior for individuals and groups with greater economic resources, whereas norms were more important in economically disadvantaged groups and contexts (Boer & Fischer, 2013; Eom et al., 2018; Morren & Grinstein, 2016).

However, in the current pandemic, the available evidence points to possibly different relationships. For example, contrary to what would be expected from post-modernization theory, wealth is negatively correlated with both COVID-19 cases and mortality rates as well as a failure to adopt widespread preventive behaviors (Gelfand et al., 2021; Kochańczyk & Lipniacki, 2021; Li, 2021; Valev, 2020). The mechanisms underlying these negative relationships are unclear. The relationship with COVID-related deaths may be driven by the older age of high-income countries (Li, 2021; Valev, 2020). However, the higher infection rates even when controlling for testing rates and reduced adherence to prevention measures may imply that the greater economic resources and availability of more advanced health care systems raised expectations that the system would be able to cope with the demands (Guillén, 2021; Motta Zanin et al., 2020). In contexts where economic resources are limited (and public health systems are more fragile), individuals may have been more motivated to follow health guidelines given the lack of financial resources to cope with demands. As a consequence, greater national wealth may

Table 2. Overall Results of the Meta-Analysis.

Variables	Fixed ES	*SE*	95% CI	Random ES	*SE*	95% CI	ML ES	*SE*	95% CI	*Q*	τ^2	I^2 (%)	H^2	*N*	*k*
Behavioral intentions															
Attitudes	.488	.005	[.479, .497]	.557	.044	[.472, .643]	.576	.067	[.444, .708]	2,253.70	.099	98.52	67.55	46,521	65
Subjective norms	.367	.004	[.358, .376]	.449	.038	[.374, .524]	.446	.043	[.360, .532]	2,986.09	.075	98.13	53.49	52,905	72
Descriptive norms	.243	.010	[.223, .265]	.281	.066	[.151, .410]	.281	.067	[.151, .410]	155.10	.017	90.00	10.00	9,540	17
Injunctive norms	.266	.010	[.246, .285]	.269	.067	[.138, .399]	.298	.084	[.132, .463]	137.85	.174	91.08	11.21	10,428	17
PBC	.419	.005	[.410, .428]	.479	.039	[.401, .558]	.490	.046	[.398, .582]	3,251.15	.071	98.06	51.54	45,537	60
Behavior															
Attitudes	.388	.007	[.375, .401]	.378	.039	[.301, .454]	.464	.062	[.344, .586]	1,177.19	.057	97.02	33.55	22,533	39
Subjective norms	.346	.007	[.332, .359]	.311	.040	[.233, .389]	.398	.048	[.299, .496]	804.11	.050	96.92	32.49	21,763	33
Descriptive norms	.217	.011	[.197, .238]	.158	.054	[.053, .263]	.262	.137	[−.006, .531]	230.45	.030	95.39	21.68	8,992	11
Injunctive norms	.288	.011	[.266, .310]	.194	.037	[.122, .266]	.299	.085	[.132, .465]	162.47	.012	88.53	8.72	8,107	10
PBC	.320	.007	[.305, .334]	.365	.044	[.280, .451]	.466	.084	[.294, .638]	1,021.58	.057	97.08	34.25	19,066	31

Note. All effect sizes and variance estimates are significant at $p < .01$. PBC = perceived behavioral control.

weaken effects of TPB variables on both behavioral intentions and behaviors.

To address these questions, we present a meta-analysis of studies available by early February 2021 that have used TPB-constructs (attitudes, subjective norms, PBC) to predict intentions and behaviors that protect individuals and communities (including vaccination intentions) as well as mitigating behaviors that may help individuals and communities deal with the current pandemic (e.g., blood donations, using online systems for learning, payment and information searching). Analyzing the performance of TPB constructs in a pandemic environment in which behavior is collectively oriented (compared to more common applications associated with voluntary, self-focused health scenarios) provides important baseline information on the applicability of TPB for the current and possible future pandemics and helps to contextualize effect sizes for collective health behaviors compared to evidence collected in previous research focused on individually relevant behaviors. We predict that COVID-19-related protection behaviors have collective action properties, which likely strengthen subjective norm effects compared to individually focused behaviors, for which subjective norms are typically less important (Armitage & Conner, 2001; Cialdini et al., 1999; McDermott et al., 2015; Riemer et al., 2014; White et al., 2009).

In terms of contextual moderators, first we test whether levels of subjective norm perceptions at the group level strengthen the link between individual-level subjective norms and behavioral intentions/behaviors (with the expectation that the effect should be stronger for behaviors compared to behavioral intentions). Second, we explore the impact of individualism–collectivism on the correlations between attitudes, subjective norms, and PBC on both behavioral intentions and behaviors. Cross-cultural research would predict strengthening of attitude and perceived behavior control effects on intentions and behaviors in more individualistic societies and strengthening of subjective norm effects in more collectivistic societies. Alternatively, effects for all variables might be strengthened in more collectivistic societies due to the collective action properties of COVID-19-related behaviors. Third, we test whether societal tightness–looseness strengthens subjective norm associations with intentions and behavior. Finally, we explore the role of national wealth on correlations, with post-modernization theory predicting strengthened attitudes and PBC effects on intentions and behaviors in richer contexts, whereas subjective norms are expected to show stronger effects in more economically disadvantaged settings. However, the current evidence points toward weaker adherence and higher infection and mortality rates in richer nations; therefore, wealth may weaken effects across societies in the current pandemic.

Table 3. The Relative Variance Contributions in the Three-Level Model.

Pairs of variables	Level 1	Level 2	Level 3	ICC
Attitudes–intentions	1.21	46.04	52.75	.534
Subjective norms–intentions	1.71	98.29	0.00	.099
PBC–intentions	1.81	83.28	14.91	.152
Attitude–behavior	2.46	51.61	45.93	.471
Subjective norms–behavior	3.07	96.93	0.00	.00
PBC–behavior	1.97	37.13	60.90	.621

Note. ICC = intraclass correlation coefficient.

Method

We conducted a literature search using APA PsycINFO and PubMed on February 2, 2021, using the keywords "theory of

Table 4. The Cross-Level Moderating Effects of Subjective Norm Sample Levels on Subjective Norm Associations with Behavioral Intentions and Behavior.

	Fixed			Random			ML		
Variable	ES	*SE*	95% CI	ES	*SE*	95% CI	ES	*SE*	95% CI
Behavioral intentions									
Intercept	.094***	.028	[.040, .149]	.269	.170	[−.065, .603]	.313	.137	[.046, .581]
Norm levels	.346***	.039	[.271, .421]	.198	.233	[−.259, .655]	.149	.189	[−.221, .518]
Behavior									
Intercept	.185***	.039	[.110, .260]	.111	.142	[−.168, .389]	.017	.123	[−.223, .259]
Norm levels	.204***	.049	[.107, .300]	.229	.186	[−.136, .594]	.482**	.162	[.165, .798]

Note. Effects are unstandardized regressions weights. Fixed = fixed effects analysis; random = empirical Bayes estimators; ML = three-level multilevel analysis with REML estimator.
***$p < .001$. **$p < .01$. *$p < .05$.

planned behavior" or "theory of reasoned action" or "TPB" or "TRA" with "Covid" or "pandemic." We also searched PsyArXiv and Google Scholar for unpublished manuscripts. Inclusion criteria were as follows: (a) the study had to be conducted after Jan 1, 2020, and focus on the COVID-19 pandemic; (b) variables related to subjective norms, attitudes, or PBC were measured; (c) behavioral intentions or behaviors geared toward preventing or protecting individuals or communities from spreading and infecting people with COVID-19 (e.g., social distancing behaviors, mask wearing, hand washing, seeking correct information), mitigation behaviors that decrease the susceptibility of individuals to fall sick or decrease negative side effects of lockdown measures (e.g., continuing physical activity, seeking online support, donating blood, hoarding behaviors, mask recycling) or COVID-19 vaccination intentions were measured; (d) the study population was 18 years of age or older on average; and (e) information that allows the calculation of effect sizes was reported. Figure 1 shows the flow chart of study inclusion.

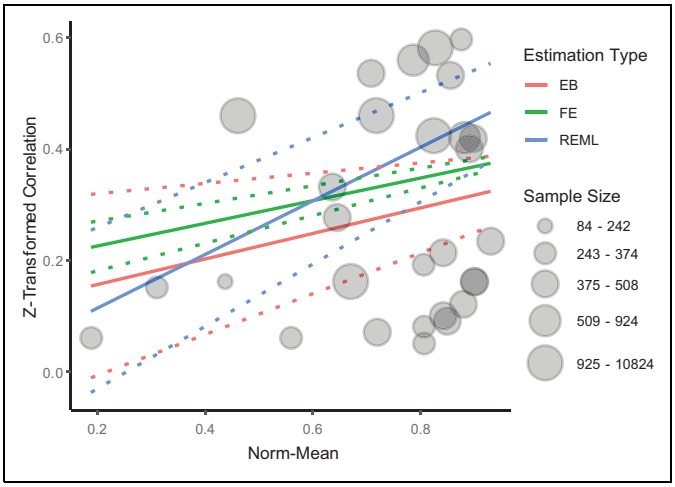

Figure 4. The moderating effect of subjective norm sample means on the subjective norm–behavior association. *Note.* Dotted lines indicate 95% confidence intervals. FE = fixed effects analysis; EB = random effects analysis with empirical Bayes estimators; REML = three-level multi-level analysis with REML estimator.

Variables

Economic wealth. We used the gross domestic product (GDP) in Purchase Power Parity per capita for the year 2019 (World Bank, 2020).

Individualism–collectivism. We used a previously validated score for individualism (Fischer & Boer, 2011; Fischer & Van de Vliert, 2011), which averaged normalized scores for Inglehart's survival versus well-being dimension, Hofstede's Individualism index, and Schwartz's autonomy versus embeddedness score for teachers and students (Hofstede, 2001; Inglehart, 1997; Schwartz, 1994).

Tightness-looseness. We standardized and combined available tightness–looseness data (Gelfand et al., 2011, 2021). The two scores were highly correlated ($r = .86$). Higher scores indicate greater tightness.

Sample-specific subjective norm scores. We collected the reported means for subjective norms and converted scores to a 0–1 metric (Cohen et al., 1999). Higher scores indicate greater endorsement of subjective norms.

Effect sizes. We coded correlation coefficients between either behavioral intentions or self-reported behaviors with attitudes, subjective norms, and PBC for each uniquely identifiable sample or behavior. Subjective norms in this theoretical framework are conceptualized as "perceived social pressure to perform or not to perform the behavior" (Ajzen, 1991, p. 88). Subjective norms are often interpreted as injunctive norms, that is, perceptions of whether significant others approve a specific behavior (Armitage & Conner, 2001). For studies reporting different types of norms instead of subjective norms as per TPB, we coded the injunctive norm component (White et al., 2009). If injunctive norms were reported for different social groups, we coded the norm for the socially most proximal group (e.g., family, Farias & Pilati, 2020). For exploratory purposes, we separately coded the injunctive and descriptive norm components, if reported by the authors. This

Table 5. Individualism Effects on TPB.

		Behavioral Intention			Behavior		
Estimation method	Variable	ES	*SE*	95% CI	ES	*SE*	95% CI
Attitudes	$k = 65$				$k = 39$		
FE	Intercept	.489***	.005	[.480, .498]	.422***	.008	[.406, .438]
	Individualism	−.036***	.006	[−.047, −.025]	−.057***	.008	[−.072, −.042]
EB	Intercept	.533***	.040	[.456, .611]	.430***	.045	[.342, .518]
	Individualism	−.082^	.042	[−.165, .001]	−.088*	.042	[−.170, −.006]
REML	Intercept	.572***	.068	[.438, .706]	.491***	.064	[.367, .616]
	Individualism	−.067	.085	[−.232, .099]	−.090	.065	[−.216, .037]
Subjective norms	$k = 72$				$k = 33$		
FE	Intercept	.367***	.004	[.359, .376]	.362***	.008	[.345, .378]
	Individualism	−.052***	.005	[−.062, −.042]	−.026***	.008	[−.041, −.011]
EB	Intercept	.452***	.032	[.389, .5165]	.345***	.047	[.253, .436]
	Individualism	−.080*	.034	[−.147, −.01]2	−.056	.042	[−.138, .026]
REML	Intercept	.443***	.043	[.359, .526]	.420***	.054	[.309, .531]
	Individualism	−.087^	.049	[−.183, .00]9	−.048	.052	[−.153, .058]
PBC	$k = 60$				$k = 31$		
FE	Intercept	.422***	.005	[.413, .432]	.435***	.009	[.416, .453]
	Individualism	.040***	.006	[.028, .051]	−.169***	.009	[−.187, .152]
EB	Intercept	.508***	.036	[.438, .578]	.452***	.043	[.368, .536]
	Individualism	.007	.038	[−.068, .082]	−.151***	.039	[−.228, −.074]
REML	Intercept	.482***	.047	[.388, .575]	.474***	.052	[.372, .577]
	Individualism	−.046	.058	[−.161, .070]	−.196***	.053	[−.300, −.093]

Note. Estimates are unstandardized regression weights. FE = fixed effects analysis; EB = random effects analysis with empirical Bayes estimators; REML = three-level multilevel analysis with REML estimator; TPB = theory of planned behavior.
***$p < .001$. **$p < .01$. *$p < .05$. ^$p < .10$.

allows us to explore whether injunctive or descriptive norm elements are more important in this behavioral context. If authors reported experiential versus instrumental attitudes, we coded the instrumental attitude component. If authors reported capacity versus autonomy components of PBC, we coded the capacity component. If authors reported standardized path or regression coefficients, we estimated the correlation (Peterson & Brown, 2005). All correlation coefficients were *r*-to-*z* transformed, and the invariance variance component was calculated using the sample size (Rosenthal & Rubin, 2003). We report fixed effects meta-analyses, random effects meta-analyses with empirical Bayes estimates (Berkey et al., 1995; C. N. Morris, 1983), and three-level multilevel meta-analyses (Konstantopoulos, 2011) with effect sizes nested in studies and studies nested in countries using REML estimation. We report all three types of analyses given the unequal distribution of variances (see Tables S1–S3), which tends to bias random effects models and gives greater weight to smaller samples (Borenstein et al., 2009; Schwarzer et al., 2015). All analyses were conducted using the metafor (Viechtbauer, 2010), robumeta (Fisher & Tipton, 2015), and dmetar packages (Harrer et al., 2019) in R (R Core Team, 2021).

Results

Descriptive Results

In total, we included 355 effect sizes from 101 samples reported in 83 manuscripts from 31 countries ($N = 66{,}023$). Table 1 contains all the descriptive information at the country level and Figure 2 shows a geographical representation of the countries represented in our study. We show the correlation between all variables at country level in Figure 3. All data were collected online or via phone interviews. An overview of the included studies, detailed analyses of average effects using different estimation methods, a list of included studies and information on publication status, theoretical approach, analysis type, sample characteristics and data collection period are available in the supplement (see Tables S1–S31 and Figures S1–S15).

Relative Importance of Attitudes, Norms, and PBC

To explore the relative importance of TPB constructs for predicting behavioral intentions and behaviors for COVID-19, we first report the baseline-level results in the total sample (see Table 2 for full information; see Tables S4–S9). For behavioral intentions, the overall strongest effect across estimation methods was found for attitudes, followed by PBC and finally subjective norms. The effects of injunctive or descriptive norms compared to subjective norms were weaker by about .08 or more. The difference between injunctive versus descriptive norms was empirically negligible and the confidence intervals were overlapping. For behavior, the same ordering of effect sizes was found, with the strongest z-transformed correlation being observed for attitudes, followed by PBC and subjective norms. Distinct injunctive versus descriptive norms

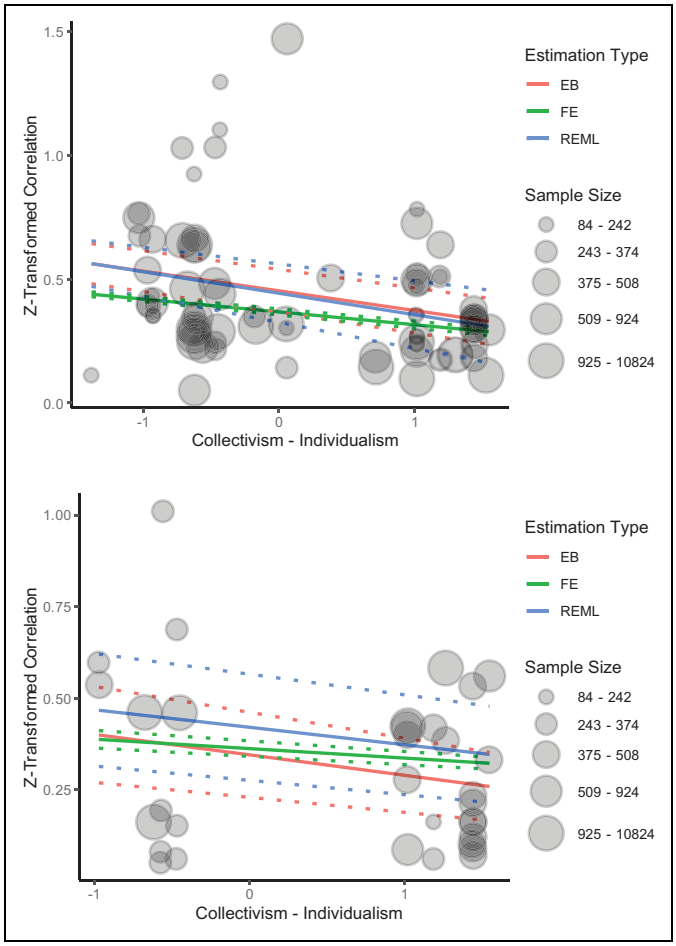

Figure 5. Example effects of Individualism on the subjective norm correlations with behavioral intentions (above) and behaviors (below). *Note*. Dotted lines indicate 95% confidence intervals. FE = fixed effects analysis; EB = random effects analysis with empirical Bayes estimators; REML = three-level multilevel analysis with REML estimator.

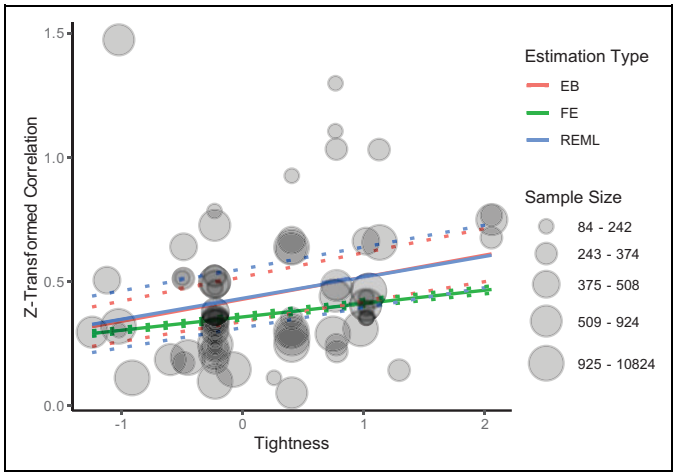

Figure 6. Example effects of tightness on the subjective norm correlations with behavioral intentions. *Note*. Dotted lines indicate 95% confidence intervals. FE = fixed effects analysis; EB = random effects analysis with empirical Bayes estimators; REML = three-level multilevel analysis with REML estimator.

effect sizes were again of smaller magnitude compared to subjective norms. The variance estimates suggested high heterogeneity, therefore, a search for possible moderators was warranted. Table 3 reports the relative variance estimates at each level. Subjective norm associations varied primarily between samples, whereas attitude and PBC associations with intentions and behavior varied both between samples and between nations in our samples.

To explicitly test the relative strength of the three components among those studies that included all of them, we conducted an analysis with robust variance estimation and using small sample corrections (Fisher & Tipton, 2015; Tanner-Smith et al., 2016). Focusing on behavioral intentions first ($I^2 = 98.00$; $\tau^2 = .068$), the estimate for attitudes was .577 ($SE = .0499$, 95% CI [.476, .677]), $p < .00001$. The effect for PBC was not significantly different from attitudes: $b = -.083$ ($SE = .0570$, 95% CI [−.197, .031]), $p = .15$. However, the subjective norm effect was significantly weaker compared to the effect of attitudes: $b = -.122$ ($SE = .0484$, 95% CI [−.219, −.025]), $p = .014$.

In contrast, for behaviors, there was no significant difference between the three components ($I^2 = 97.49$; $\tau^2 = .056$): $b_{\text{attitudes}} = .404$ ($SE = .065$, 95% CI [.265, .543], $p = .000019$); relative effect of PBC compared to attitudes: $b_{\text{PBC-attitudes}} = .015$ ($SE = .069$, 95% CI [−.129, .158], $p = .83$); relative effect of subjective norms compared to attitudes: $b_{\text{norms-attitudes}} = .001$ ($SE = .057$, 95% CI [−.117, .120], $p = .98$). Therefore, in studies that measured all three components, attitudes were a significantly stronger predictor than subjective norms for behavioral intentions, but there was no difference between the three components in relation to behaviors.

Moderation by Sample-Level Effects

To examine the influence of sample-level norms, we examined the moderating effect of perceived subjective norm means on the relationship between norms and behavioral intentions and between norms and behaviors (Table 4). For behavioral intentions, only the fixed effects analysis was significant ($Q_B = 80.89$, $k = 51$, $p < .001$). For behaviors, both the fixed effect analysis ($Q_B = 17.01$, $k = 29$, $p < .001$) and the REML multilevel analysis ($Q_B = 8.90$, $k = 29$, $p < .01$) were significant. The EB analyses indicated that 1.94% of the overall variance in the subjective norm–behavior associations were explained by subjective norm means. A conditional variance analysis focusing on the reduction in σ^2_2 (the variability at the study level) showed a reduction in variability by 78.91% when including the subjective norm means. This suggests that the overall effect is relatively small but substantive when focusing on the variability of studies within nations specifically. In line with our predictions, if subjective norm levels were higher on average in the sample, the correlation between norms and behaviors was strengthened (see Figure 4).

Table 6. GDP per Capita (Expressed in Purchase Power Parity) Effects on TPB.

		Behavioral Intention			Behavior		
Estimation method	Variable	ES	*SE*	95% CI	ES	*SE*	95% CI
Attitudes	$k = 65$				$k = 39$		
FE	Intercept	.483***	.005	[.474, .492]	.382***	.007	[.368, .395]
	GDP	−.028***	.005	[−.038, −.019]	−.044***	.007	[−.057, −.031]
EB	Intercept	.519***	.029	[.443, .594]	.378***	.037	[.306, .450]
	GDP	−.085*	.039	[−.161, −.009]	−.091*	.037	[−.164, −.017]
REML	Intercept	.553***	.069	[.419, .687]	.422***	.062	[.300, .543]
	GDP	−.101	.074	[−.245, .043]	−.102	.053	[−.206, .001]
Subjective norms	$k = 72$				$k = 33$		
FE	Intercept	.364***	.004	[.355, .372]	.346***	.007	[.333, .360]
	GDP	−.027***	.005	[−.036, −.018]	−.008	.006	[−.020, .004]
EB	Intercept	.440***	.032	[.378, .503]	.311***	.038	[.254, .386]
	GDP	−.074*	0032	[−.137, −.011]	−.069^	.039	[−.145, .007]
REML	Intercept	.438***	.042	[.356, .520]	.395***	.047	[.303, .487]
	GDP	−.076^	.041	[−.156, .005]	−.062	.04	[−.139, .016]
PBC	$k = 60$				$k = 31$		
FE	Intercept	.431***	.005	[.421, .440]	.330***	.007	[.315, .344]
	GDP	.073***	.005	[.063, .082]	−.060***	.007	[−.074, −.046]
EB	Intercept	.509***	.035	[.440, .578]	.366***	.041	[.285, .447]
	GDP	.000	.036	[−.070, .070]	−.089*	.042	[−.171, −.006]
REML	Intercept	.491***	.049	[.396, .586]	.441***	.082	[.281, .601]
	GDP	−.048	.047	[−.097, .087]	−.080	.060	[−.198, .049]

Note. All effects are unstandardized regression weights. GDP effects are scaled. FE = fixed effects analysis; EB = random effects analysis with empirical Bayes estimators; REML = three-level multilevel analysis with REML estimator; GDP = gross domestic product; TPB = theory of planned behavior.
***$p < .001$. **$p < .01$. *$p < .05$. ^$p < .10$.

Nation-Level Effects

First, we examined the impact of individualism–collectivism on correlations (Table 5). Of the 18 estimates, all but two (for PBC-behavioral intentions) were negative supporting a collective action interpretation of the pandemic responses. In line with cultural predictions, greater individuals weakened the subjective norm associations with intentions and behavior, which was significant for three out of the six tests (and one further effect, $p = .07$). This supports general theorizing about individualism and norms. However, the significant weakening of the effects for attitudes on intentions and behavior for three of the six tests (with one further effect, $p = .05$) suggests collective action properties of COVID-19-related behavioral intentions and behavior. Attitudes showed a stronger association with behavior in contexts where the collective interest takes priority (see Figure 5). This collective action interpretation was also supported by patterns observed for PBC–behavior associations: All three tests were negative and significant. We reran the analysis with robust variance estimates across all three components simultaneously. The effect of individualism was highly significant for both behavioral intentions: $b = -.080$, $SE = .026$, 95% CI [−.132, −.027], $p < .01$ and for behaviors: $b = -.105$, $SE = .048$, 95% CI [−.206, −.004], $p < .05$. This provides strong support for a collective action interpretation.

Next, we tested whether tightness–looseness strengthened subjective norm associations with behavioral intentions and behavior. The effects were positive in all analyses indicating a strengthening of subjective norm effects in contexts that are culturally tighter. The fixed effects models for both behavioral intention ($b = .054$, $SE = .007$, 95% CI [.041, .067], $p < .001$) and behavior ($b = .046$, $SE = .014$, 95% CI [.019, .074], $p < .001$) were statistically reliable. In addition, the effects for behavioral intentions estimated with Empirical Bayes estimators ($b = .089$, $SE = .046$, 95% CI [−.001, .178], $p = .05$) and REML ($b = .084$, $SE = .055$, 95% CI [−.024, .193], $p = .13$) were indicating statistical trends. Explained variance with the EB estimator was 4.23%. Therefore, cultural tightness effects were in line with predictions (see Figure 6) but only statistically significant when estimated with a fixed effects model. Full results are reported in the supplement.

Finally, we tested GDP effects on all associations (Table 6). Only two of the 18 estimated relationships were positive, with the remainder being negative or zero. Six of the 18 effects were not statistically reliable, one was representing a statistical trend, and the remainder were statistically significant (see Figure 7 for an example of GDP moderating the attitude–behavior links and PBC-behavior links). When rerunning the analyses across all TPB constructs with robust variance estimation, the GDP effect represented a negative trend for behavioral intentions: $b = -.057$, $SE = .031$, 95% CI [−.120, .007], $p = .07$, but was not reliable for behaviors: $b = -.082$, $SE = .058$, 95% CI [−.215, .050], $p = .19$. Therefore, the overall pattern was more aligned with observations that high average income weakens behavioral prevention efforts.

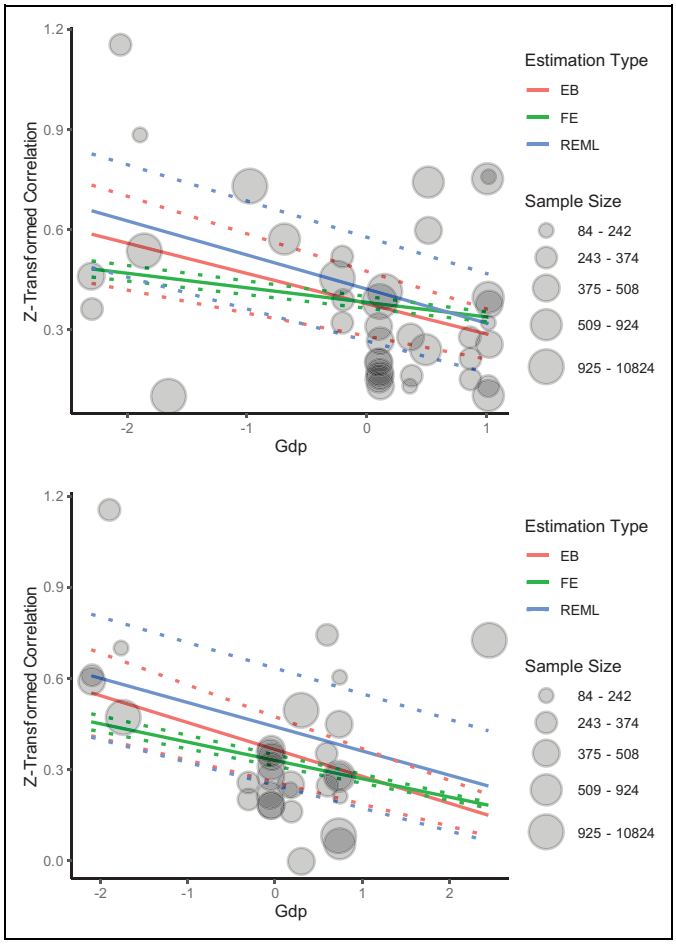

Figure 7. Effect of GDP per capita (expressed in Purchase Power Parity) on Attitude–behavior correlations (above) and PBC-behavior correlations (below). *Note*. Dotted lines indicate 95% confidence intervals. FE = fixed effects analysis; EB = random effects analysis with empirical Bayes estimators; REML = three-level multilevel analysis with REML estimator.

Discussion

We report a meta-analysis of TPB-based studies to predict protection and mitigating behavior as well as vaccination intentions to protect against COVID-19. Among the variables, PBC showed overall the strongest correlations with both intentions and behaviors, implying that increasing perceived efficacy of protective actions is key for behavior and behavioral intentions. This is especially noteworthy given the current debates around the efficacy of vaccines for protecting against the virus. A second noteworthy finding is that subjective norms showed strong correlations with both behavioral intentions and behaviors, which contrasts with previous observations that subjective norms are weak behavioral predictors (Ajzen, 1991; Armitage & Conner, 2001; McDermott et al., 2015; White et al., 2009). The effects of subjective norms were statistically weaker compared to attitudes for behavioral intentions but not empirically distinguishable for behaviors. In the current pandemic, norms appear to be equally strong predictors of behaviors as attitudes or PBC.

Further emphasizing the importance of creating strong norms to combat COVID-19, the effect of subjective norms on behavior was strengthened, if subjective norms were rated higher at the sample level, implying that subjective norms were more salient and participants on average felt that important others were strongly supportive of behaving in a protective way. This aligns with recent dynamic norms approach to behaviors, which indicated that injunctive norm perceptions of important others play a central role for shifting norms that strengthen behavioral adherence (Sparkman & Walton, 2017, 2019). Given the polarization in some Western societies and the complex structural inequalities around health care and economic resources, more research on these social norm effects is needed to identify avenues for effective norm interventions (Bicchieri & Funcke, 2018; Prosser et al., 2020; Templeton et al., 2020).

Third, our analyses highlight that societal-level economic conditions and cultural values are important but that the pandemic context shifted how these macro-societal dynamics operate. Overall, our patterns suggested that COVID-related behaviors have collective action properties because effects were weakened in more individualistic and more economically advanced contexts. The effects of individualism were consistent (as shown by the analyses with robust variance estimates), implying that in more collectivistic settings, individuals with more positive attitudes, stronger subjective norms, and higher PBC are more likely to behave in ways that protect the larger collective (Biddlestone et al., 2020; Riemer et al., 2014). In line with other studies (Gelfand et al., 2021), we also found some evidence that Tightness–Looseness plays a role for protective behavior in the current pandemic. Again, this points toward the important role of social norms in general.

Briefly focusing on additional analyses reported in the supplement, we found weak (but nevertheless reliable) temporal effects on TPB performance. For example, PBC effects on behavioral intentions declined over time, implying that perceived efficacy of protective behaviors may be declining, which is likely to further increase stress within the public health system. Considered in the larger context of the results, our findings suggest that it will be of paramount importance to strengthen second-order collective perceptions that COVID-relevant behaviors are effective and that others share this efficacy belief (Jachimowicz et al., 2018, see also the issue of dynamic norms discussed above), especially when extended lockdowns wear down compliance motivation and increase economic strains.

One limitation of our study is that the current studies represent a snapshot of intentions and behaviors during an ongoing pandemic. The situation remains dynamic and needs to be closely monitored during the next waves of the virus. Our variance estimates also indicated that sampling effects within nations are important, in particular for subjective norms, which may have limited our ability to find significant effects. Focusing on the overall distribution of studies, we managed to sample studies from countries that were affected early by the virus (China, South Korea) as well as countries that have a strong history of publishing psychological studies (United States, United Kingdom). We have no studies from Africa and scarce representation from other

world regions despite extensive searches using Google Scholar and PsyArXiv. Our study distribution reflects the larger bias in psychology, but what is encouraging is that the samples that we included were primarily population samples, with only a small minority of studies relying on student samples (see the supplement for further information).

With all these limitations, some key takeaway messages from our analysis are the relative importance of subjective norms for both intentions and behaviors, especially if the effect of subjective norms on behavior is amplified via strong norms at the population level. Our analysis is an important testing case because previous research primarily focused on behaviors that are self-centered and under full control of the individual. In contrast, COVID-19-related actions are often mandated by legislation or are recommended by health authorities in order to protect others. Hence, the behaviors protect an individual, but this person may not necessarily be at high risk of the disease, yet in its aggregate, these behavioral actions have an impact on the larger community, turning COVID-19-related behaviors into collective action problems. In line with this interpretation, effects were overall stronger in more collectivistic settings. Looking forward, is it important to motivate individuals to vaccinate while continuing to follow behavioral guidelines to reduce contamination until herd immunity is reached. This requires collective behavioral actions. Our research demonstrates the relevance of the TPB in this effort. In particular, we demonstrated the importance of the reinforcing strength of subjective norms across individual and community levels as well as the need to consider societal-level economic and cultural effects for understanding and motivating health behaviors.

Author Contributions

Ronald Fischer conceptualized the study, conducted the literature search, coded the data, and wrote the first draft; both authors analyzed the data, revised the paper, and approved the final version.

Declaration of Conflicting Interests

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Supplemental Material

The supplemental material is available in the online version of the article.

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