The relationship between cultural tightness–looseness and COVID-19 cases and deaths: a global analysis

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Summary

Background **The COVID-19 pandemic is a global health crisis, yet certain countries have had far more success in limiting COVID-19 cases and deaths. We suggest that collective threats require a tremendous amount of coordination, and that strict adherence to social norms is a key mechanism that enables groups to do so. Here we examine how the strength of social norms—or cultural tightness–looseness—was associated with countries' success in limiting cases and deaths by October, 2020. We expected that tight cultures, which have strict norms and punishments for deviance, would have fewer cases and deaths per million as compared with loose cultures, which have weaker norms and are more permissive.**

Methods **We estimated the relationship between cultural tightness–looseness and COVID-19 case and mortality rates as of Oct 16, 2020, using ordinary least squares regression. We fit a series of stepwise models to capture whether cultural tightness–looseness explained variation in case and death rates controlling for under-reporting, demographics, geopolitical factors, other cultural dimensions, and climate.**

Findings **The results indicated that, compared with nations with high levels of cultural tightness, nations with high levels of cultural looseness are estimated to have had 4·99 times the number of cases (7132 per million *vs* 1428 per million, respectively) and 8·71 times the number of deaths (183 per million *vs* 21 per million, respectively), taking into account a number of controls. A formal evolutionary game theoretic model suggested that tight groups coordinate much faster and have higher survival rates than loose groups. The results suggest that tightening social norms might confer an evolutionary advantage in times of collective threat.**

Interpretation **Nations that are tight and abide by strict norms have had more success than those that are looser as of the October, 2020. New interventions are needed to help countries tighten social norms as they continue to battle COVID-19 and other collective threats.**

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Introduction

The COVID-19 pandemic is a global health crisis. In early 2020, the virus quickly spread from its epicentre in Wuhan, China, across the planet. By early April, 2020, severe acute respiratory syndrome coronavirus 2 had infected more than 1 million people and killed more than 60 000 people worldwide. As of Oct 16, 2020, nearly 39 million cases and over 1 million deaths worldwide had been reported. Certain countries had far more success than others in slowing the rate of COVID-19 cases and deaths. Singapore and Taiwan effectively contained the virus, with 9865 cases (five deaths) per million in Singapore and 22 cases (0·3 deaths) per million in Taiwan, whereas Brazil and the USA each had more than 24 000 cases and approximately 700 deaths per million by October, 2020.

The difference between countries in their ability to limit cases and deaths might be linked to cultural variation in the strength of social norms. Psychology has long recognised the power of social norms—implicit or explicit rules that constrain behaviour—for coordinating action.[1] Yet countries around the globe vary widely in their adherence to social norms. In earlier research,[2] we showed that tighter cultures such as China, Singapore, and South Korea have stricter rules and punishments for deviance, whereas looser cultures such as Brazil, Spain, and the USA have weaker norms and are much more permissive. Tight cultures have a lot of order—ie, less crime and more coordination and self-control;[3] loose cultures have less order and coordination, but have more openness—ie, more tolerance and creativity. Variation in tightness–looseness is tied to cultures' histories of social and ecological threat. As compared with loose cultures, tight cultures tend to have higher historical rates of natural disasters, disease prevalence, resource scarcity, and invasions,[2,4] which has also been found among non-industrial societies.[5] More generally, tightness–looseness theory suggests that strict rules, and the order and coordination that tightness confers, has helped groups to coordinate to survive under high threat throughout history.[2,5,6]

Research in context

Evidence before this study

In 2011, we introduced a theory and measure of cultural tightness–looseness, which reflects the degree to which cultures have strict norms and punishments for deviance. Cultures that had tighter norms included Japan, China, Singapore, and Austria, whereas cultures that had looser norms included Italy, Spain, Brazil, and the USA. In this study, we found that variation in tightness–looseness is related to cultures' histories of social and ecological threat. As compared with loose cultures, tight cultures generally have higher historical rates of natural disasters, disease prevalence, resource scarcity, and invasions, which has also been found among non-industrial societies. More generally, tight–loose theory suggests that strict rules—and the order and coordination they confer—help groups to survive collective threats. The present study examined whether this theory and measure can explain variation in COVID-19 cases and deaths as of October, 2020.

Added value of this study

Countries across the globe have varied widely in their ability to limit cases and deaths during the COVID-19 crisis. Understanding what explains this country-level variation is not only important for the advancement of theory, but also can help guide interventions aimed at addressing future collective threats. We show that tight nations generally were more successful than loose nations in dealing with COVID-19 as of October, 2020. Nations with high levels of looseness were estimated to have had 4·99 times the cases and 8·71 times the deaths as compared with nations with high levels of tightness. A formal evolutionary game theoretic model found that tight groups cooperate much faster under threat and have higher survival rates than loose groups. The results suggest that tightening social norms might confer an evolutionary advantage in times of collective threat.

Implications of all of the available evidence

Our results suggest that nations that abide by strict norms have had more success in limiting COVID-19 cases and deaths than those that are looser as of October, 2020. Research in behavioural economics, political science, and psychology has shown that it is possible to shift social norms on a wide range of behaviours. New interventions are needed to help countries tighten social norms as they continue to battle COVID-19 and future collective threats.

See **Online** for appendix

For **Our World in Data** see https://ourworldindata.org/coronavirus-data

For **data, codes, and materials** see https://osf.io/47pe8/

To date, it has not been possible to examine how countries around the world respond to the same collective threat happening simultaneously. The COVID-19 pandemic provides a natural context to test whether differences in cultural tightness–looseness are related to collective outcomes during a global threat. Our analyses are based on the premise that this pandemic is a global threat, which requires large-scale cooperation and coordination to be addressed. Earlier research suggests that tight cultures might be better able to respond to a global pandemic than loose cultures because they might be more willing to abide by cooperative norms. Loose cultures, which have more permissive norms, might have more difficulty following rules. Here we predict that cultural tightness–looseness will explain variation in cases and deaths during COVID-19. Beyond advancing theory on how social norms help societies respond to collective threat, this research holds important practical implications that might help societies deal with later waves of COVID-19 and future threats more generally.

We tested the effect of cultural tightness–looseness on case and death rates per million by October, 2020. Our analyses first controlled for numerous potential factors, such as under-reporting of COVID-19 cases, wealth, inequality, population density, migration, government efficiency, other dimensions of cultural variation such as power distance and collectivism, political authoritarianism, median age, non-pharmaceutical government interventions, and other factors (eg, spatial interdependence, relational mobility, climate, mandated [Bacillus Calmette-Guérin] vaccination, population size, and experience with severe acute respiratory syndrome [SARS]). To complement these data, we also developed a formal computational model that suggests that cultural variation in adherence to cooperative norms can help groups survive during existential threats such as the COVID-19 pandemic (appendix pp 1–3).

Methods

COVID-19 cases and deaths

We retrieved data on COVID-19 from Our World in Data, which provides daily updates of the number of COVID-19 cases and deaths globally, starting from the first documented case using data from the European Centre for Disease Prevention and Control. To avoid confounding these COVID-19 data with nations' population sizes, we downloaded data on cases and deaths per million citizens as of Oct 16, 2020. We log-transformed cases and deaths so that they were normally distributed. The data includes 57 countries for which tightness data are available. The data were downloaded on Oct 16, 2020, and are available online.

Cultural tightness–looseness

To assess cultural tightness–looseness, we used a previously published measure[2] that averages six items, including, for example, "There are many social norms that people are supposed to abide by in this country", "There are very clear expectations for how people should act in most situations", "In this country, if someone acts in an inappropriate way, others will strongly disapprove", and "People in this country almost always comply with social norms".[2] The measure captures the strength of norms in a nation and the tolerance for people who violate norms. We originally validated this measure across 33 nations in 2011, then expanded the validation with a new sample of 57 nations.[7] Nations' scores on the new measure correlated highly with our earlier 33-nation measure (r=0·87, p<0·0001). The scale also has high predictive validity for explaining a diverse array of phenomena, including national differences in creativity rates, stock price synchrony, organisational leadership preferences, chief executive officer discretion, expatriation success, and global differences in prejudice, among other outcomes (appendix p 1).

Accounting for under-reporting

Under-reporting is an important concern when analysing COVID-19 case rates. The number of COVID-19 cases are likely to be under-reported, and this under-reporting might vary meaningfully across countries. Many sources have suggested that testing is critically linked to under-reporting, such that nations with higher rates of testing have more accurately tracked the virus.[8–10] In particular, countries that had widespread testing are cited as having lower under-reporting estimates (eg, South Korea), than countries that were slow to adopt widespread testing (eg, the USA). Accordingly, we used the ratio of tests to cases as our primary proxy for under-reporting. If there were similar numbers of tests and cases (a low test-case ratio), this suggested that a country was mostly testing people who are symptomatic (as in the USA) and there was probably a high rate of under-reporting. In contrast, there was likely less under-reporting for countries that had a high ratio of tests to cases, because many people receiving tests were asymptomatic (as in South Korea). We downloaded data on COVID-19 tests and cases from Our World in Data on Oct 16, 2020. If testing data was

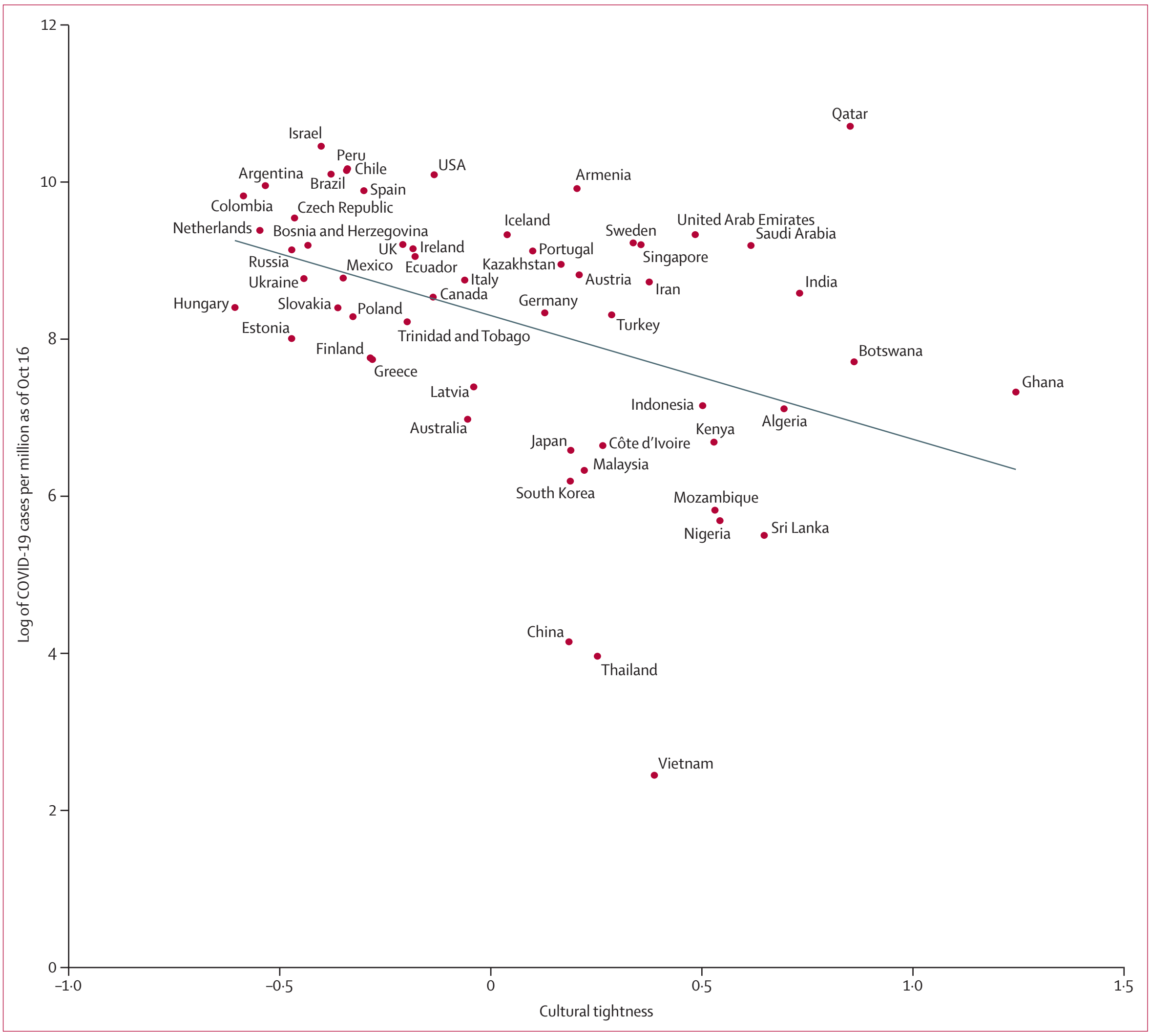

Figure 1: **The association of cultural tightness and logged cases per million (Oct 16, 2020)**
This scatterplot does not include any covariates.

not available for Oct 16, 2020, we used the data from the closest available date. We also controlled for a number of other indicators of under-reporting, including tests per thousand, delay-adjusted case-fatality ratio estimates of under-reporting,[11] and health-care capacity via the number of beds per thousand from Our World in Data. Replicating our results with these other measures shows that they are robust to multiple potential under-reporting proxies.

Covariates

Our analysis included several additional key controls that could plausibly relate to cross-cultural variation in how effectively nations have contained COVID-19: economic development (gross domestic product per capita in current US dollars, retrieved from the World Bank, 2019), inequality (Gini coefficients, retrieved from the World Bank, most recent year available), population density (log-transformed people per km², retrieved from the World Bank, 2018), median age (from the US Central Intelligence Agency estimates hosted on Wikipedia, 2018), government efficiency (from the World Bank, 2016), and percent migrants (from the UN Population Division, 2019). Power distance and collectivism were based on Hofstede.[12] We also controlled for political authoritarianism with the Political Regime Characteristics scale from the Center for Systemic Peace, and emphasise that our theory does not imply that authoritarian governments are better suited to lower case and death rates than democratic cultures. For our analyses on deaths, in addition to these controls, we added World Bank data on all-cause mortality rate from 2018, the most recent year before the COVID-19 outbreak that had complete data for our sample. All-cause mortality is an important covariate because it is the mortality rate expected from nations before the onset of COVID-19. We also controlled for a number of non-pharmaceutical interventions that governments implemented to examine whether cultural tightness predicts above and beyond these government measures. Specifically, we controlled for the time it took for countries to have mandatory stay-at-home lockdowns (from their first case) and the average level of governmental stringency from the first available data until Oct 15, 2020, using data from the Oxford COVID-19 Government Response Tracker. Finally, we also replicated the results while excluding China and Russia, which have both come under scrutiny for under-reporting cases. All covariates were standardised before analysis. A list of all countries and scores for our primary measures is given in the appendix (p 46). The sample size in the models varies slightly due to missing data for some of the control variables. All sources for all variables are presented in the appendix for ease of reproducibility (pp 43–45).

For the **Oxford COVID-19 Government Response Tracker** see https://covidtracker.bsg.ox.ac.uk

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The funder of the study had no role in study design, data collection, data analysis, data interpretation, or writing of

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10
Constant	8·14 (7·79 to 8·50); p<0·0001	8·07 (7·76 to 8·38); p<0·0001	8·06 (7·67 to 8·45); p<0·0001	8·16 (7·76 to 8·55); p<0·0001	8·18 (7·81 to 8·55); p<0·0001	8·09 (7·76 to 8·41); p<0·0001	8·04 (7·72 to 8·36); p<0·0001	8·07 (7·75 to 8·38); p<0·0001	8·25 (7·91 to 8·58); p<0·0001	8·13 (7·84 to 8·42); p<0·0001
Test-case ratio	−0·84 (−1·20 to −0·48); p<0·0001	−0·79 (−1·11 to −0·48); p<0·0001	··	··	··	−0·81 (−1·14 to −0·48); p<0·0001	−0·90 (−1·30 to −0·50); p<0·0001	−0·79 (−1·12 to −0·47); p<0·0001	−0·84 (−1·12 to −0·55); p<0·0001	−0·87 (−1·16 to −0·58); p<0·0001
Tests per thousand	··	··	0·18 (−0·50 to 0·86); p=0·6088	··	··	··	··	··	··	··
DA-CFR under-reporting	··	··	··	−0·04 (−0·54 to 0·46); p=0·8782	··	··	··	··	··	··
Hospital beds per thousand	··	··	··	··	−0·22 (−0·73 to 0·28); p=0·3919	··	··	··	··	··
GDP per capita	0·82 (0·29 to 1·35); p=0·0043	0·44 (−0·05 to 0·94); p=0·0881	0·56 (−0·07 to 1·19); p=0·0865	0·49 (−0·15 to 1·12); p=0·1412	0·56 (−0·06 to 1·19); p=0·0851	0·40 (−0·28 to 1·08); p=0·2558	0·43 (−0·11 to 0·98); p=0·1281	0·45 (−0·10 to 1·00); p=0·1141	0·28 (−0·22 to 0·79); p=0·2825	0·49 (0·04 to 0·95); p=0·0398

(Table 1 continues on next page)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10
(Continued from previous page)										
Income inequality, Gini coefficient	0·26 (–0·15 to 0·67); p=0·2267	0·44 (0·07 to 0·81); p=0·0241	0·55 (0·09 to 1·00); p=0·0246	0·40 (–0·07 to 0·87); p=0·1001	0·31 (–0·16 to 0·78); p=0·2032	0·43 (0·03 to 0·84); p=0·0404	0·44 (0·06 to 0·82); p=0·0301	0·43 (–0·04 to 0·90); p=0·0779	0·51 (0·11 to 0·91); p=0·0171	0·05 (–0·38 to 0·47); p=0·8272
Population density	–0·19 (–0·56 to 0·19); p=0·3309	–0·004 (–0·34 to 0·33); p=0·9824	–0·04 (–0·46 to 0·39); p=0·8675	–0·10 (–0·54 to 0·34); p=0·6661	–0·11 (–0·50 to 0·27); p=0·5723	–0·01 (–0·37 to 0·35); p=0·9498	0·05 (–0·32 to 0·43); p=0·7827	–0·002 (–0·35 to 0·34); p=0·9893	–0·04 (–0·43 to 0·34); p=0·8391	–0·01 (–0·32 to 0·30); p=0·9354
Percent migrants	0·42 (–0·03 to 0·86); p=0·0750	0·58 (0·19 to 0·98); p=0·0060	0·56 (–0·11 to 1·22); p=0·1090	0·68 (0·16 to 1·20); p=0·0133	0·64 (0·15 to 1·14); p=0·0137	0·58 (0·12 to 1·04); p=0·0181	0·44 (–0·14 to 1·02); p=0·1408	0·58 (0·18 to 0·98); p=0·0069	0·40 (–0·04 to 0·84); p=0·0874	0·40 (0·02 to 0·78); p=0·0456
Government efficiency	–0·59 (–1·09 to –0·08); p=0·0276	–0·20 (–0·68 to 0·28); p=0·4142	–0·35 (–0·94 to 0·25); p=0·2583	–0·39 (–1·04 to 0·27); p=0·2531	–0·41 (–1·01 to 0·18); p=0·1771	–0·16 (–0·66 to 0·35); p=0·5461	–0·17 (–0·65 to 0·31); p=0·4877	–0·20 (–0·69 to 0·29); p=0·4203	0·01 (–0·50 to 0·51); p=0·9841	0·03 (–0·44 to 0·49); p=0·9122
Tightness	..	–0·80 (–1·21 to –0·40); p=0·0003	–0·85 (–1·36 to –0·33); p=0·0026	–0·77 (–1·27 to –0·27); p=0·0041	–0·80 (–1·28 to –0·32); p=0·0019	–0·81 (–1·23 to –0·39); p=0·0005	–0·90 (–1·34 to –0·47); p=0·0002	–0·81 (–1·25 to –0·37); p=0·0008	–0·73 (–1·12 to –0·34); p=0·0009	–0·68 (–1·05 to –0·30); p=0·0011
Collectivism	..	..	..	..	..	0·02 (–0·50 to 0·54); p=0·9406	..	..	..	..
Power distance	..	..	..	..	..	–0·0005 (–0·52 to 0·52); p=0·9986	..	..	..	..
Authoritarianism	..	..	..	..	..	..	0·25 (–0·31 to 0·80); p=0·3961	..	..	..
Median age	..	..	..	..	..	..	..	–0·02 (–0·55 to 0·52); p=0·9519	..	..
Days until lockdown	..	..	..	..	..	..	..	..	–0·20 (–0·52 to 0·13); p=0·2435	..
Government stringency	..	..	..	..	..	..	..	..	..	0·66 (0·26 to 1·07); p=0·0027
Observations	50	50	50	52	55	49	49	50	39	49
R^2	0·55	0·67	0·48	0·42	0·43	0·67	0·68	0·67	0·75	0·74
Adjusted R^2	0·49	0·61	0·39	0·33	0·35	0·59	0·61	0·60	0·68	0·68
Residual SE	1·27 (43)	1·10 (42)	1·38 (42)	1·44 (44)	1·39 (47)	1·13 (39)	1·11 (40)	1·12 (41)	0·98 (30)	1·01 (40)
F statistic	8·71 (6, 43); p<0·0001	12·14 (7, 42); p<0·0001	5·55 (7, 42); p=0·0001	4·58 (7, 44); p=0·0006	5·17 (7, 47); p=0·0002	8·83 (9, 39); p<0·0001	10·57 (8, 40); p<0·0001	10·37 (8, 41); p<0·0001	11·33 (8, 30); p<0·0001	13·98 (8, 40); p<0·0001

Data are estimate (95% CI), SE (df), or *F* statistic (df). DA-CFR=delay-adjusted case fatality ratio. GDP=gross domestic product.

***Table 1:* Logged cases per million**

the report. All authors had full access to all the data in the study and had final responsibility for the decision to submit for publication.

Results

Cultural tightness was negatively related to cases per million (r –0·41, p=0·0017, n=57) without controls. These case rates at different levels of cultural tightness are shown in figure 1. To test whether this effect was robust to other factors, our first model included covariates and their association with variance in cases per million (table 1). In our second model, which included cultural tightness above and beyond these covariates (table 1), we observed a robust main effect of cultural tightness (b –0·80, SE 0·21, t –3·91, p=0·0003, n=50). To put these results in context, reconverting the log-transformed cases through exponentiation, nations with high levels (Z score 1) of cultural tightness are estimated to have had an average of 1428 cases per million, whereas nations with high levels (Z score –1) of cultural looseness are estimated to have had an average of 7132 cases per million. Models 3–5 replicated the results of the second model with alternative measures of under-reporting (table 1). Model 6 replicated the effects including collectivism and power distance (table 1). This model replicated our main effect of cultural tightness (b –0·81, SE 0·21, t –3·80, p=0·0005). This replication was important to demonstrate the robustness of our results, because cultural collectivism and power distance each correlate positively with cultural tightness.[2] Model 7 replicated the effects of cultural tightness, while controlling for political authoritarianism (b –0·90, SE 0·22, t –4·09, p=0·0002; table 1). The remaining models replicated the main effect of cultural tightness, while including median age and non-pharmaceutical government interventions (table 1).

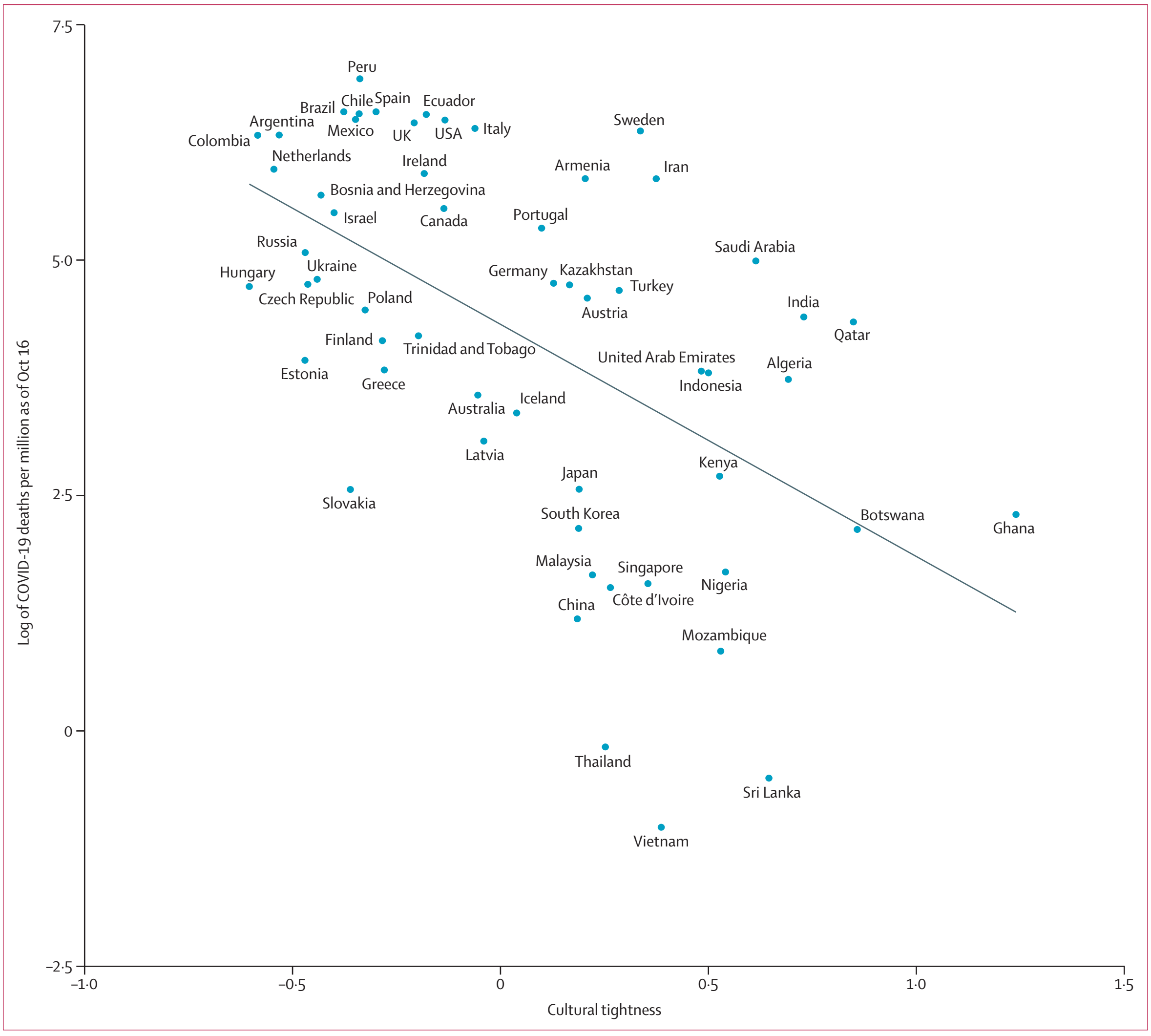

Figure 2: **The association of cultural tightness and logged deaths per million (Oct 16, 2020)**
This scatterplot does not include any covariates.

Our appendix includes additional robustness checks controlling for spatial interdependence, population size, mandated Bacillus Calmette-Guérin vaccination,[13] relational mobility, climate, and previous experience with SARS. They also summarise model diagnostics that illustrate no undue effect of heteroscedasticity on the results, no evidence of problematic multicollinearity, and no cases with undue influence on our estimated coefficients (no studentised residuals with significant deviation from the predicted value). Our analyses also confirmed that the main effect of cultural tightness replicated when excluding Russia (b –0·80, SE 0·21, t –3·82, p=0·0004), and China (b –0·74, SE 0·19, t –3·86, p=0·0004). We also report (non-significant) interactions between tightness and collectivism and tightness and government efficiency in the appendix (pp 3–5).

We next replicated these models for COVID-19 death rates. Cultural tightness was negatively related to deaths

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Constant	4·17 (3·69 to 4·65); p<0·0001	4·13 (3·71 to 4·56); p<0·0001	4·10 (3·65 to 4·55); p<0·0001	4·16 (3·73 to 4·60); p<0·0001	4·13 (3·70 to 4·56); p<0·0001	4·35 (3·87 to 4·83); p<0·0001	4·16 (3·77 to 4·56); p<0·0001
Mortality	–0·04 (–0·65 to 0·58); p=0·9078	–0·31 (–0·87 to 0·25); p=0·2828	–0·35 (–1·00 to 0·29); p=0·2872	–0·48 (–1·07 to 0·11); p=0·1175	–0·36 (–0·97 to 0·25); p=0·2517	–0·27 (–0·96 to 0·42); p=0·4418	–0·11 (–0·66 to 0·45); p=0·7083
GDP per capita	1·14 (0·42 to 1·87); p=0·0034	0·54 (–0·17 to 1·25); p=0·1400	0·08 (–0·88 to 1·04); p=0·8710	0·56 (–0·22 to 1·33); p=0·1660	0·47 (–0·31 to 1·26); p=0·2424	0·69 (–0·09 to 1·47); p=0·0933	0·73 (0·07 to 1·38); p=0·0350
Income inequality, Gini coefficient	0·18 (–0·43 to 0·78); p=0·5645	0·26 (–0·28 to 0·79); p=0·3513	0·58 (–0·04 to 1·19); p=0·0747	0·16 (–0·39 to 0·71); p=0·5620	0·32 (–0·29 to 0·93); p=0·3093	0·24 (–0·38 to 0·85); p=0·4564	–0·05 (–0·59 to 0·49); p=0·8570
Population density	–0·41 (–0·91 to 0·09); p=0·1142	–0·28 (–0·72 to 0·17); p=0·2304	–0·15 (–0·65 to 0·34); p=0·5477	–0·34 (–0·83 to 0·14); p=0·1666	–0·29 (–0·74 to 0·16); p=0·2178	–0·41 (–0·93 to 0·10); p=0·1274	–0·27 (–0·68 to 0·13); p=0·1977
Percent migrants	0·17 (–0·50 to 0·83); p=0·6272	0·27 (–0·32 to 0·86); p=0·3698	0·45 (–0·21 to 1·11); p=0·1868	0·44 (–0·29 to 1·17); p=0·2410	0·27 (–0·32 to 0·86); p=0·3779	0·07 (–0·64 to 0·78); p=0·8387	0·14 (–0·40 to 0·68); p=0·6196
Government efficiency	–1·14 (–1·84 to –0·44); p=0·0025	–0·58 (–1·26 to 0·10); p=0·1026	–0·42 (–1·12 to 0·28); p=0·2450	–0·60 (–1·29 to 0·08); p=0·0891	–0·56 (–1·25 to 0·13); p=0·1166	–0·59 (–1·36 to 0·17); p=0·1389	–0·37 (–1·05 to 0·30); p=0·2828
Tightness	..	–1·07 (–1·62 to –0·52); p=0·0004	–1·08 (–1·67 to –0·49); p=0·0008	–0·95 (–1·51 to –0·38); p=0·0020	–1·03 (–1·62 to –0·44); p=0·0013	–0·94 (–1·50 to –0·39); p=0·0022	–0·96 (–1·47 to –0·44); p=0·0007
Collectivism	..	..	–0·50 (–1·26 to 0·25); p=0·1994	..	..	..	..
Power distance	..	..	–0·24 (–0·95 to 0·47); p=0·5181	..	..	..	..
Authoritarianism	..	..	..	–0·43 (–1·08 to 0·23); p=0·2070	..	..	..
Median age	..	..	..	..	0·18 (–0·62 to 0·97); p=0·6667	..	..
Days until lockdown	..	..	..	..	..	–0·12 (–0·62 to 0·38); p=0·6325	..
Government stringency	..	..	..	..	..	..	0·75 (0·16 to 1·34); p=0·0160
Observations	55	55	50	53	55	43	53
R^2	0·28	0·45	0·51	0·48	0·45	0·53	0·56
Adjusted R^2	0·19	0·37	0·39	0·39	0·35	0·41	0·48
Residual SE	1·82 (48)	1·60 (47)	1·58 (40)	1·60 (44)	1·62 (46)	1·53 (34)	1·46 (44)
F statistic	3·05 (6, 48); p=0·0130	5·45 (7, 47); p=0·0001	4·55 (9, 40); p=0·0004	5·11 (8, 44); p=0·0002	4·71 (8, 46); p=0·0003	4·70 (8, 34); p=0·0006	7·08 (8, 44); p<0·0001

Data are estimate (95% CI), SE (df), or *F* statistic (df), unless stated otherwise. GDP=gross domestic product.

***Table 2*: Logged deaths per million**

per million (r –0·54, p<0·0001, n=57) without any controls. Figure 2 shows the association between tightness and deaths. To examine the robustness of this effect, our first model included covariates and their association with variance in death rates per million across nations (table 2). Our second model, which included cultural tightness above and beyond these covariates (table 2), showed a main effect of cultural tightness (*b* –1·07, SE 0·28, t –3·82, p=0·0004, n=55). Reconverting the log-transformed deaths through exponentiation, nations with high levels (Z score 1) of cultural tightness are estimated to have had an average of 21 deaths per million, whereas nations with high levels (Z score –1) of cultural looseness are estimated to have had an average of 183 deaths per million.

Model 3 (table 2) showed that the effects of cultural tightness replicated controlling for collectivism and power distance (*b* –1·08, SE 0·30, t –3·61, p=0·0008). Model 4 (table 2) replicated the effects of tightness while controlling for political authoritarianism (*b* –0·95, SE 0·29, t –3·29, p=0·0020). The remaining models replicated the main effect of cultural tightness on death rates while including median age and non-pharmaceutical government interventions (table 2).

As with our COVID-19 case-specific models, our models of death rates showed no evidence of cases that had undue influence, multicollinearity, or any undue influence of heteroscedasticity on the results (appendix p 5), and replicated with a variety of other control variables. COVID-19 deaths are less likely to be under-reported than COVID-19 cases. Many people with COVID-19 are asymptomatic, and people who are asymptomatic are unlikely to be tested, yet people who die from COVID-19 generally express some symptoms. For this reason, under-reporting rates are less relevant when analysing COVID-19 deaths. We note that our results were unchanged regardless of whether or not we controlled for test-case ratio or other measures of under-reporting (appendix p 4). Our analyses also confirmed that the effect of cultural tightness on deaths per million was replicated when excluding Russia (*b* –1·08, SE 0·28, t –3·79, p=0·0004) and China (*b* –1·09, SE 0·28, t –3·90, p=0·0003).

Our theory suggests that nations with tight cultures might be better at containing COVID-19 because their citizens are more willing to cooperate under threat, which translates to higher survival rates. While our nation-level correlational analysis cannot address this mechanistic explanation, in the appendix (pp 1–3), we present an evolutionary game theoretic model, which provides support for the notion that loose cultures take longer to cooperate under collective threat.

Discussion

Countries across the globe have varied widely in their ability to limit cases and deaths during the COVID-19 pandemic. Understanding what explains this variation is not only important for the advancement of theory, but also to guide interventions aimed at addressing future collective threats.

Our theory posits that collective threats require a tremendous amount of coordination to survive, and that abidance of social norms is one key coordination mechanism that enables groups to do so. Consistent with this notion, our empirical data show societal variation in the strength of social norms, or cultural tightness–looseness, is associated with COVID-19 case and mortality rates as of October, 2020. Research in the social sciences has long recognised the power of social norms for understanding a wide range of behaviour, from health decisions,[14] to proenvironmental behaviour,[15,16] to voting and charitable giving.[17] Here, we show that cultural variation in the tightness of social norms helps to explain collective health outcomes during a global pandemic. Nations with high levels of cultural tightness were better able to limit cases and deaths than nations that were looser. These effects were replicated when controlling for various measures of under-reporting, wealth, inequality, population density, migration, government efficiency, collectivism, power distance, political authoritarianism, median age, non-pharmaceutical government interventions, spatial interdependence, climate, relational mobility, mandated (Bacillus Calmette-Guérin) vaccination, population size, and experience with SARS. We suggest that tight cultures might be more effective in dealing with COVID-19 because they more readily adopt cooperative behaviours. Our evolutionary game theoretic model illustrates that when groups are under threat, norms for cooperation evolve much faster in tight as compared with loose cultures, which results in higher survival rates (appendix pp 1–3). Not all loose cultures did poorly and not all tight cultures were successful at limiting cases and deaths during COVID-19. Yet the results show that cultural looseness can be a liability during collective threat.

In preparation for later waves of COVID-19 and future pandemics, societies can learn from what tight countries have done that helped them be so successful. In Taiwan, for example, increased self-regulation and voluntary norm abidance with physical distancing, wearing masks, and avoiding large crowds enabled the country to keep both the infection and mortality rates low without shutting down the economy entirely. Similar early coordinated responses among citizens following social norms have been noted in South Korea, Singapore, and Germany. In contrast, countries such as Brazil, the USA, and Spain have struggled to contain the virus and citizens were more likely to violate rules put in place.

This research suggests that interventions are needed to strengthen social norms surrounding behaviours such as physical distancing and wearing face masks, particularly in loose cultures. Although social norms do not change instantaneously, decades of research in behavioural economics, political science, and psychology shows that social norms can be changed. Interventions have been highly successful in changing social norms concerning drinking and driving,[18] energy conservation,[19,20] tax compliance,[21] intergroup prejudice,[22] and bullying and harassment.[23,24] Likewise, research has illustrated that entire countries can tighten norms that have become too loose.[3] In what has become known as the Youth in Iceland study, parents and local governments joined together to successfully tighten social norms to reduce alcohol and drug abuse, which has been regarded as a model programme in Europe.[25]

We suggest that interventions to tighten during COVID-19 can be successful if they are tailored to fit countries' unique circumstances. For example, at the onset of an outbreak, loose countries that have generally had fewer chronic ecological threats might embrace a sense of optimism that turns out to be unrealistic. Consistent with this, our supplemental exploratory analyses with data from 22 countries from YouGov found that people in loose cultures had far less fear of COVID-19 than people in tight cultures. Tightness was significantly correlated with the percentage of people who were scared of contracting COVID-19 over the first 100 days since the first case (r 0·53; p=0·010), and over the entire study period (r 0·49; p=0·020). To put this in context, as compared with nations with high levels of cultural looseness, nations with high levels of cultural tightness had a much higher percentage of people who were scared of catching COVID-19 (71% *vs* 52% averaged over the first 100 days, and 70% *vs* 49% averaged across the entire study period; appendix pp 6–7). This suggests that interventions might need to focus on coordinated, clear, and consistent risk communication[26] in loose cultures. Likewise, given that people in loose cultures have generally enjoyed much more latitude, they might be more likely to resist increased constraint. Accordingly, interventions might need to help people maintain a sense of psychological autonomy or they might elicit psychological reactance and backfire.[27] More generally, intervention tournaments—wherein a pool of different strategies are evaluated simultaneously[28]—are a fruitful way to determine the winning strategies for tightening social norms during COVID-19. A preregistered tournament of seven different interventions is currently being implemented with representative samples in the USA to tighten norms around wearing masks (unpublished).

We emphasise that our empirical data are limited in that they are correlational. Although we have taken several precautions to account for the correlational nature of our data, including controlling for important covariates (eg, under-reporting, societal wealth, inequality, population density, migration, government efficiency, among other variables), and put forth a formal computational model in the appendix (pp 1–3) that examines causal dynamics, causality cannot be inferred from our empirical analyses. We also note that cultural tightness is not the only factor associated with COVID-19 cases and deaths. Future research should explore other factors, such as political leaders' personal beliefs about the seriousness of COVID-19, the nature and extent of political polarisation, and the quality of governments' communications about the virus, which might also be associated with responses to COVID-19. We also emphasise that there might be within-country variation in response to the pandemic that needs to be modelled in future research. Moreover, our analyses pertain to cases and deaths as of October, 2020. Although countries with tight social norms had lower case and death rates as of this period, they are still vulnerable in later stages if they loosen prematurely. Finally, when the threat of COVID-19 gradually subsides, evolutionary models predict an accompanying loosening of social norms.[6] This prediction suggests that nations need to negotiate social norms so that they can deploy tight and loose norms depending on the level of threat, or what has been referred to as tight–loose ambidexterity.[3] Having both strict adherence to cooperative norms to contain the virus along with experimentation to find creative technical solutions might prove to be an adaptive strategy for COVID-19.

COVID-19 has already reshaped our world and we urgently need to understand the factors that are linked to its spread. Rarely have we been able to examine cultural variation in reactions to a pandemic that simultaneously affects all the world's nations—a natural context that allows us to test how culture influences societal functioning during times of threat. By examining the strength of social norms across countries, we can begin to understand why certain societies were better able to limit cases and deaths. Social norm interventions will be critical for helping groups to tighten norms to effectively mitigate COVID-19 when necessary and to deal with future collective threats.

Contributors

All authors conceived the project. C-YC, JCJ, MW, and DP analysed the empirical data. XP, DN, and MJG designed the evolutionary game theoretic model, and XP did the simulations. MJG, JCJ, C-YC, XP, DP, MW, and ED wrote the Article. MW and DP verified the underlying data.

Declaration of interests

All authors declare no competing interests.

Data sharing

All data, codes, and materials used in the analysis are available from the authors online. Author approval is not required for use.

For **data, codes, and materials** see https://osf.io/47pe8/

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