




PERSPECTIVE: COVID-19 PANDEMIC

Effects of containment and closure policies on controlling the COVID-19 pandemic in East Asia

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Growing efforts have been made to pool coronavirus data and control measures from countries and regions to compare the effectiveness of government policies. We examine whether these strategies can explain East Asia's effective control of the COVID-19 pandemic based on time-series data with cross-correlations between the Stringency Index and number of confirmed cases during the early period of outbreaks. We suggest that multidisciplinary empirical research in healthcare and social sciences, personality, and social psychology is needed for a clear understanding of how cultural values, social norms, and individual predispositions interact with policy to affect life-saving behavioural changes in different societies.

Keywords: civic responsibility, containment and closure policies, COVID-19, multidisciplinary perspective, vigilance.

Efforts are growing to pool coronavirus data and control measures from countries and regions to build epidemic models and inform government policies (Enserink, & Kupferschmidt, 2020; Gibney, 2020). Modelling and forecasting the spread of the coronavirus diseases 2019 (COVID-19) focus on nonpharmaceutical public health interventions such as social distancing, shelter in place orders, disease surveillance, contact tracing, isolation, and quarantine (Bertozi et al., 2020). Are these interventions effective in preventing transmission of the COVID-19 pandemic? This concerns collective regulation of individuals' behaviours, a question central to our discipline.

Researchers have proposed a biopsychosocial model of behavioural medicine to go beyond a narrow focus on the medical aspects of health and illness and to integrate biological, personal (psychological), and environmental (primarily social) dimensions of medical practice (Leigh & Reiser, 1980; Schwartz, 1982). The outbreak of the severe acute respiratory syndrome (SARS) epidemic in 2003 stimulated empirical research to expand this model and form a broader framework for public health (Cheung, 2004). For example, in response to SARS,

wishful thinking was associated with avoiding public places and high-risk people whereas empathic responding was related to preventive health behaviours (Lee-Bagglely et al., 2004). While dispositional optimism did not differ between Chinese and Canadians, unrealistic optimism was higher among Chinese than Canadians in the context of SARS, but the Chinese reported more positive changes brought by SARS, reflecting their dialectical views on negative events (Ji et al., 2004). Likewise, the Chinese values of prudence, industry, and civic harmony positively predicted both direct (e.g., monitoring one's temperature daily and wearing a face mask to the doctor's office) and indirect (e.g., building up one's resistance through exercise and taking health supplements) preventive health-related behaviours to cope with SARS among Singaporeans (Chang & Sivam, 2004). Thus, promoting effective coping strategies and health behaviours in the general public should take into account social factors and cultural norms.

We use the Oxford Stringency Index (SI; Hale et al., 2020), combining eight indicators of containment and closure policies (including school closures, workplace closures, cancellation of public events, restrictions on size of gathering, closing public transport, stay-at-home requirements, restrictions on internal movement, and restrictions on international travel) to examine whether these strategies can explain East Asia's effective control of the COVID-19 pandemic during the early period of outbreaks. COVID-19 data were obtained from the

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European Centre for Disease Prevention and Control (ECDC; 2020) and the John Hopkins University Center for Systems Science and Engineering (JHU CSSE; 2020) database.

Based on time-series data from the day of the first identified case(s) to May 31, 2020, cross-correlations between the SI and number of confirmed cases in mainland China, Hong Kong, Taiwan, South Korea, Japan, and Singapore were computed after prewhitening, a procedure to remove the autocorrelation in one time series to explore the lagged associations for the two sets of time series. Figure 1 depicts the number of confirmed COVID-19 cases from the day of the first case(s) to 100 days afterward in each society, with different colors indicating the change in SI (also see Figure S1a–f for each society separately in the Supporting Information). Highest cross-correlations are summarised in Table 1.

Mainland China

According to the Situation Report of the World Health Organization (WHO) on January 21, 2020, cases of

Table 1
Summary of Highest Cross-Correlations Between Stringency Index (SI) and Confirmed COVID-19 Cases

	Confirmed Cases Leading SI		SI Leading Confirmed Cases	
	<i>r</i>	Time Lag (Days)	<i>r</i>	Time Lag (Days)
China	.199*	−4	−.299*	+20
Hong Kong	.186*	−6	−.268*	+23
Taiwan ^a	.219*	−1	−.221*	+18
South Korea	.178*	−2	−.203*	+29
Japan	.128	−11	−.193*	+30
Singapore	.149	−26	−.049	+28

^aThe highest cross-correlation is at lag 0, *r* = .230.
**p* < .05.

pneumonia of unknown etiology detected in Wuhan, China were reported to the WHO China Country Office on December 31, 2019 and subsequently to WHO by the

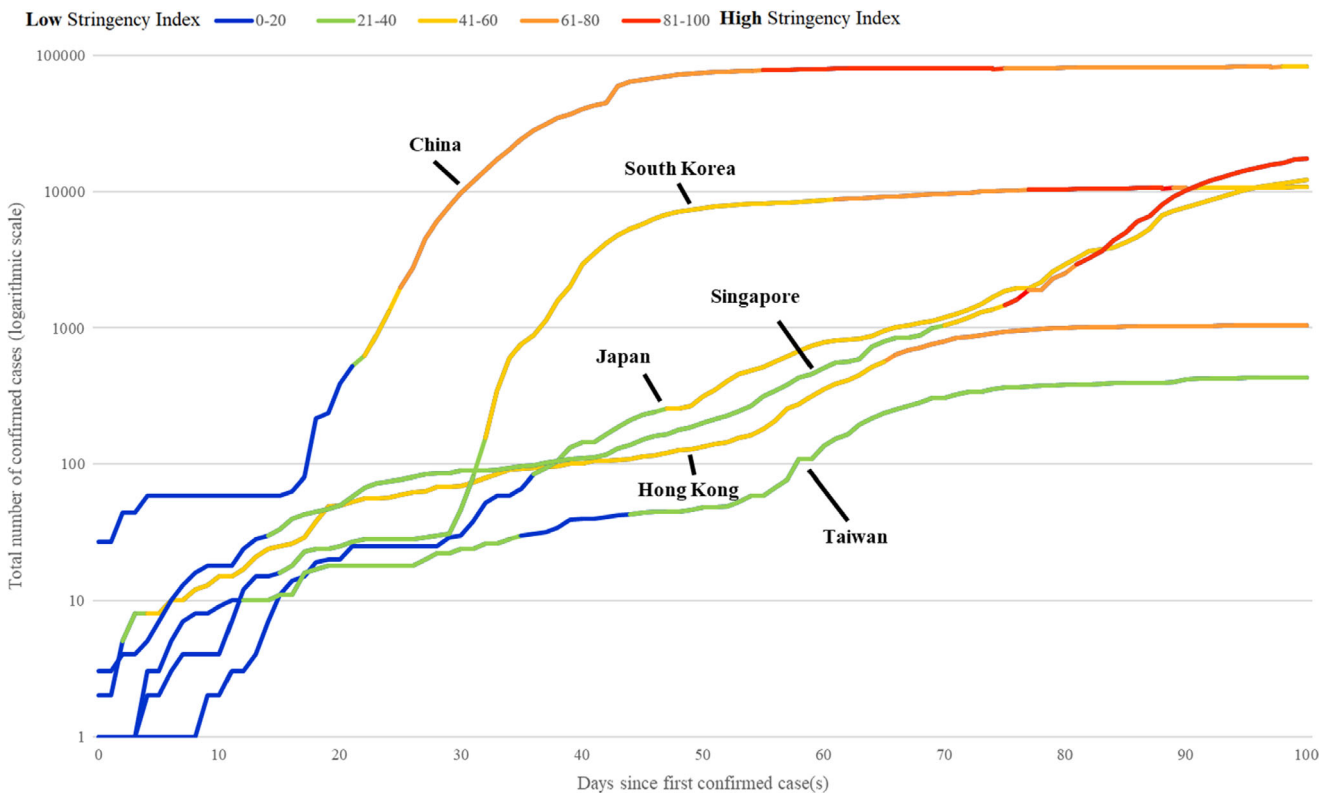


Figure 1 Total number of confirmed COVID-19 cases by each of the six countries/societies since the first confirmed case(s). Data on the Stringency Index were obtained from the Oxford COVID-19 Government Response Tracker (OxCGRT). Data on number of confirmed cases were obtained from the European Centre for Disease Prevention and Control (ECDC) and the John Hopkins University Center for Systems Science and Engineering (JHU CSSE) database. [Colour figure can be viewed at wileyonlinelibrary.com]

national authorities in China (World Health Organization, 2020). After the spread of the novel coronavirus in Wuhan and other parts of mainland China, the central government implemented stringent control measures, including the lockdown of Wuhan on January 23, 2020 as well as suspension of public transport services and cancellation of major events (SI jumping to 21 and higher, 22 days since the first reported cases; see Figure S1a in the Supporting Information). The cross-correlation result revealed that over the examined period, the increasing number of confirmed cases was associated with higher level of SI subsequently in China, with a time lag of 4 days, $r = .199$ at lag -4 (see Table 1). These efforts successfully flattened the curve of infection by February 2020, and there were more imported new cases than locally transmitted new cases in March 2020. The highest cross-correlation between SI and number of cases later was significant, suggesting the effectiveness of the implemented stringent measures in lessening the spread of COVID-19, $r = -.299$ at lag $+20$.

Hong Kong

In Hong Kong, the first two identified cases appeared in late January 2020. A few days later, the Hong Kong government declared the outbreak an emergency and responded immediately by exerting stronger border controls, reducing international travel, and closing schools (SI increasing to 41 and higher; indicated in yellow in Figure S1b in the Supporting Information). The number of new cases per day remained low and in single digits until mid-March (about 50 days after the first cases). About 2 weeks later, further restrictions on international travel and gatherings were announced, but no lockdown was implemented (SI increasing to 61 and higher; indicated in orange in Figure S1b). The short delay in implementing containment measures was evident in the highest cross-correlation, as more confirmed cases initially were associated with higher SI later, with a time lag of 6 days, $r = .186$ at lag -6 . Results also showed that these early containment and closure policies reduced subsequent numbers of cases, $r = -.268$ at lag $+23$. Moreover, citizens in Hong Kong have voluntarily adopted the use of face masks, a now-recognised effective strategy to lessen transmission, which may also have contributed to the relatively low number of cases overall during the early period of the outbreak.

Taiwan

Thus far, the impact of the pandemic has been small in Taiwan, with only seven deaths as of May 31 and most cases imported. This was achieved without locking down cities or closing schools, as indicated by the low levels of

SI (i.e., 40 and lower across time). Learning from the experience of SARS, the Taiwanese government responded to COVID-19 early on and rapidly, even before their first identified case in late January, by increasing border stringency (increasing SI to 21 and higher; indicated in green in Figure S1c in the Supporting Information). In addition to tightened border control, the government banned the export of face masks and other personal hygiene products to ensure adequate reserves for their people. Facemask use is normative on public transport in Taiwan. Authorities also communicated extensively to the public by distributing information through various forms of media. The SI and confirmed cases changed simultaneously in Taiwan, $r = .230$ at lag 0, which points to the timely and effective use of various measures in controlling the spread of COVID-19. Their success in controlling the outbreak so far has been approved and praised both locally and internationally.

South Korea

Despite an early and massive outbreak in February to March (about 30 days after the first case), the South Korean government has been effective in controlling the spread of the outbreak by implementing various control measures, with SI increasing to 41 and higher a few days after the outbreak (indicated in yellow in Figure S1d in the Supporting Information). The cross-correlation showed that the increasing number of cases was associated with higher SI later, with a time lag of 2 days, $r = .178$ at lag -2 . Development and use of medical technology for rapid and extensive testing, together with contact tracing and health-care, have played a key role in their stagewise success. For instance, mass testing has provided health authorities with critical data to keep track of and contain the outbreak. Supporting this, the cross-correlation result showed that higher SI was associated with fewer cases subsequently in South Korea, $r = -.203$ at lag $+29$. The effectiveness of these strategies may be attributed, at least in part, to the fact that the first outbreak occurred in one particular region involving members of a religious group, Shincheonji. The South Korean government has also been recognised for its transparent and effective communication to the public on managing the crisis and distributing COVID-19 related information.

Japan

Due to the concern of the prospects for hosting the 2020 Olympics and the economic impact of restrictions, the Japanese government implemented stronger border control in early February and enforced more stringent measures including school closure in late February, almost 37 days after the first identified case (SI increasing to 21

and higher; indicated in green in Figure S1e in the Supporting Information). In the early stage of combating the pandemic, authorities were criticised for their passive response to the outbreaks, ineffective case reporting and testing system, and lack of communication and transparency. The delay in government response is reflected in the nonsignificant cross-correlations between number of cases and subsequent level of SI. Nevertheless, when a surge in infections occurred in March, the government and health authorities had encouraged people to comply with social distancing and working from home measures on a voluntary basis, and the Prime Minister declared a state of emergency in early April to enact compulsory containment measures that could not be authorised under the current law. The SI has increased to 41 and higher since March, about 48 days after the first case (indicated in yellow in Figure S1e in the Supporting Information). The cross-correlation result suggested that these measures have been effective against COVID-19 in Japan without any lockdown, $r = -.193$ at lag +30.

Singapore

The Singapore government had initial success in containing COVID-19 by immediately implementing several containment measures, including border controls, testing and tracing incoming passengers for potential risks, and by mandating mask-wearing. The SI rose to 21 and higher in 15 days after the first identified cases (indicated in green in Figure S1f in the Supporting Information). A contact-tracing application was also developed and released in March, but the take-up and usage rate of the application was relatively low. In April, a second wave of infections hit the poor migrant workers residing in overcrowded dormitories. The number of cases in Singapore continued to rise, and foreign workers had accounted for the majority of them, despite the government introducing a stringent set of control measures (SI increasing to 41 and higher; indicated in yellow in Figure S1f). The cross-correlation result revealed that stringent containment measures did not seem effective in lowering the number of cases in Singapore during the period examined. The current situation has stimulated considerable debate about fairness and equity issues in the society, which highlights the need for the government to work more in partnership with its people to regain its reputation as being a successful model for responding to the pandemic.

Discussion

Analysing such patterns and modelling predictions enable researchers to evaluate interventions at the

country/society level. However, they cannot tease apart the effects of each control measure nor model citizens' willingness to adopt behavioural changes mandated by policy. We suggest that vigilance (at the border, with contact tracing afterward, and then extensive, fast, and inexpensive testing), civic responsibility (including heightened levels of concern for the health of others over personal freedom and convenience), underpinned by collectivist norms (including the public's willingness to call individuals out for failing to comply with safety rules), contributed to East Asia's effective control of the pandemic (Liu et al., 2020). Empirically, evidence from laboratory-confirmed COVID-19 cases and influenza surveillance data in Hong Kong shows that the transmissibility of COVID-19 and influenza declined after nonpharmaceutical interventions were implemented, including border restrictions, quarantine and isolation, distancing, and changes in population behaviour (Cowling et al., 2020), providing support for our observed patterns. Conceptually, psychologists have posited that social norms and cultural characteristics influence human behaviour for COVID-19 pandemic responses, in the sense that tight cultures such as Singapore, Japan, and China have strong social norms and low tolerance for deviance, thereby enforcing strict rules to suppress interpersonal transmission of the virus (Van Bavel et al., 2020).

In our opinion, multidisciplinary empirical research in health-care and social sciences, personality, and social psychology is needed for a clear understanding of how cultural values, social norms, and individual predispositions interact with policy to affect life-saving behavioural changes in different societies. In a large-scale, 55-country study in late March and early April 2020, Götz, Gvirtz, Galinsky, and Jachimowicz (2020) found that policy stringency and personality factors of openness to experience, conscientiousness, agreeableness, and neuroticism were all positively related to higher rates of staying at home whereas extraversion was negatively associated with staying at home. Further, stricter government policies weakened the effects of openness and neuroticism on the behaviour of sheltering-in-place. Other within-country and cross-cultural studies during the COVID-19 pandemic also have shown the interface between public health, personality, and social psychological perspectives (Huang et al., 2020; Tong et al., 2020; Zirenko et al., 2020).

Using theories, constructs, and methods of social psychology in collaboration with health and medical sciences to analyse both society-level and individual-level data in multinational studies is required to provide additional evidence on how to prevent subsequent waves of infections. A recent attempt to explain cross-country variability in the transmission of COVID-19 is a 39-country study linking cultural practices of social

relationships to growth curves of confirmed cases and deaths due to COVID-19 in the first 30 days of the outbreak (Salvador et al., 2020). Spread of the virus was found to be faster in societies with higher relational mobility, where people have more freedom and opportunities to form new relationships and terminate existing relationships, than in societies with lower relational mobility, where interpersonal relationships are generally ascribed by social roles and network structures. Analysing individual-level data can facilitate the understanding of how internalised cultural orientations such as values, thinking styles, and regulatory focus shape individual responses and coping strategies to the COVID-19 pandemic whereas identifying society-level patterns can illuminate how national culture influences the collective actions and practices related to infectious diseases (Guan et al., 2020). Therefore, a behavioural health pandemic response strategy for COVID-19 may include biopsychosocial-cultural considerations to flatten not only the curve of disease spread but also the curve of emotional distress (Kaslow et al., 2020). Theory and research should take a global perspective and provide implications for health-care professionals and policymakers to manage the long-term impacts of the pandemic and optimise future multidisciplinary efforts.

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Author contribution

Sylvia Chen and Ben Lam wrote the first draft of the article. Ben Lam analysed the data. All authors contributed to the conceptualisation and revision of the article.

Conflict of Interest

Authors declare no competing interests.

Data availability statement

Data on the Stringency Index were obtained from the Oxford COVID-19 Government Response Tracker (OxCGRT): <https://www.bsg.ox.ac.uk/research/research-projects/coronavirus-government-response-tracker>. Data on number of confirmed cases were obtained from the European Centre for Disease Prevention and Control (ECDC) and the John Hopkins University Center for Systems Science and Engineering (JHU CSSE) database: <https://github.com/CSSEGISandData>

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Supporting Information

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