COVID-19 Pandemic Global View: Containment Efforts and Implications

Bob Travica

University of Manitoba, Canada

bob.travica@umanitoba.ca

Abstract

The exploratory study reported here investigated the manner in which different countries have responded to the COVID-19 pandemic caused by the largely unknown and dangerous virus SARS-CoV-2. Based on studying still limited and evolving evidence, a model of pandemic containment strategy was created. In a testing deployment, the model was able to differentiate between three strategies of containing COVID-19 – *Restrictive, Permissive, and Hybrid.* The article frames a pandemic containment strategy as a mediator between pandemic causes and consequences, along with a capability of the health system and a government's response time. Cultural assumptions behind different strategies are also discussed. Implications for further research and for practice are outlined.

Keywords: COVID-19, pandemic containment strategy, pandemic decisions support systems, pandemic management, health informatics

1. Introduction

Since a novel coronavirus (SARS-CoV-2) was detected in China in December 2019, the new respiratory disease caused by it COVID-19 escalated into a global pandemic. At the start of December 2020, the number of global infection cases is nearing 65 million people, 1.5 million of whom have died. This is over 160 times the late March cases and 85 times the deaths at that point.

The impact of the pandemic has varied across the world. Most of the countries studied have experienced two waves of the pandemic – one the Spring and the other in the Fall. An exception is China, where the escalation happened early this year and then did not resurge to that level. Another exception is the US that may have faced three waves. As Figure 1 shows, in Spring, the cases per 1 million people ranged from 18.5 in Taiwan to 5,661 in Spain. In the Fall, Taiwan maintained the privileged rank, while the US ended up on the opposite side (29 vs. 43,803 cumulative cases/1 million).

The East vs. West comparison on the cases per million indicates that the former has maintained the caseload at the same order of magnitude during the pandemic (tens or hundreds), while the latter's caseload jumped one order of magnitude up (from thousands to tens of thousands). The fatality comparison reveal larger differences, rendering the Far East figures in a surreal light in comparison with the West. For example, South Korea recorded just 5 deaths by May 10, and totally 10 by December 3. At the same points of observation, Spain – a country with 5 million less inhabitants than S. Korea –

registered 569 and 985 deaths, respectively.

Medical science still does not know much about SARS-CoV-2. It matches by 95% the genome of the SARS virus that caused the 2002-2004 epidemic with 7-15% case fatality. SARS-CoV-2 spreads human-to-human with the reproduction number (R naught) of minimally 2.3 (one person infects 2-3 persons) caused by a high viral load early in the illness (Chen & Li, 2020). Some sources estimate R naught as high as 5.7 (Zimmer, 2020). The pathogen is airborne and survives outside a host on hard surfaces for up to 72 hours (van Doremalen et al., 2020).

SARS-CoV-2 attacks lungs and mostly men over 65 years of age. Still, other organs may be affected and there is variation regarding age groups across countries. Assessments of earlier COVID-19 severity suggest that 80% of cases get mild symptoms, 15% require medical help, and 5% end up in intensive care and possibly die (Wu & McGoogan, 2020). The death rate in the infected population is predicted to be between 0.2%-0.8% (Marteen, 2020; Sanders, 2020). The prospective evolution of SARS-CoV-2 is still uncertain.

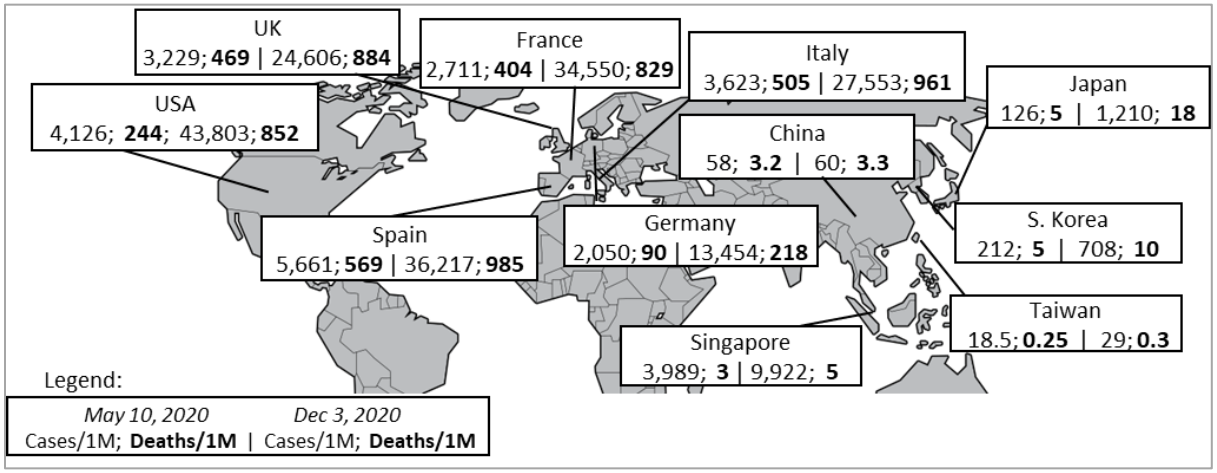

Figure 1. The Escalation of COVID-19 Between May and December 2020
(Sources: JHU Dashboard, Worldometers)

In the early 2020, the sessional influenza (flu) was confused with COVID-19 by authorities as well as laypeople around the world. However, the flu poses roughly 50% less danger than COVID-19 across different indicators and can be prevented by vaccination. The COVID-19 fatalities doubled the number of flu fatalities that have ranged from 291,000-646,000 per season (Bean et al., 1982; CDC, 2017; WHO, 2020). The speed of this virus' transmission is puzzling. A home party of 50 in a small Connecticut town became a source of infection reaching out as far as South Africa (Williamson & Hussey, 2020). A business meeting in Singapore generated a cluster that reproduced clusters in two Asian and three European countries (Lew at al., 2020). Extensive mixing of people through business and tourism in this era of globalization could have contributed to Italy's severe outbreak (BBC, 2019; Xinhuna, 2020).

These alarming facts define one side of the COVID-19 pandemic as a research problem. The other side is in the responses of the government and health authorities globally. These have been all but orderly and coordinated. A delayed response marked the crisis start in China (Lai et al., 2020). In contrast, few

neighboring countries promptly activated defenses developed in previous epidemics (Ahn, 2020; BBC/a, 2020; Chang, 2020; Choudhury, 2020; Kupferschmidt & Cohen, 2020). However, a response delay subsequently became a rule along the westward path of the pandemic. The authorities appeared passive, underestimating the threat to public health and failing to prepare health systems. Instated of safeguarding the public, some high visibility officials themselves fell victim to the disease (AFP/The Local, 2020; Goldberg, 2020).

As the patient volume escalated, health systems stalled and the authorities rushed to fire-fighting. Appeals for staying at home, washing hands, and helping in "flattening the curve" filled public discourse (Krans, 2020). The World Health Organization (WHO) contributed to the confusion for it could not determine until the last week in January whether the human-to-human transmission was possible. Moreover, in public communication, the WHO did not label the virus with "SARS" allegedly in order to avoid a mass panic (WHO/a, 2020). This move could have muted the alarm and bolstered the flu believers as well as deniers of the COVID-19 threat.

Bewildering variety of new policies have emerged. These range from declaring the state of national emergency in Spain (Harris, 2020) to confronting the pandemic with special measures in the UK while, simultaneously and rather paradoxically, taking SARS-CoV-2 off the list of high consequence infectious diseases (www.gov.uk). Borders closing and mandated quarantining have been deployed as well as plain advises on staying at home and self-isolating, enforced by financial fines or by nothing at all. Wearing non-medical facial masks has been mandatory in some countries or cities, while in others even the professionals that directly faced the public remained free to decide on mask wearing; a shortage of masks was universal.

This confusing, complex situation triggers a question: Are there any patterns in this variety of efforts at containing the COVID-19 pandemic? This question adds to the uncertainty of the COVID-19 pandemic and its pathogen to frame the research problem of this exploratory study. Its purpose is to contribute to research that may help understand strategies in containing the COVID-19 pandemic.

2. Research Design

This report is an abbreviated version of a study conducted in the first half of 2020 (Travica, 2020). However, the report brings updates and some enhancements. Just key points of the study's research design will be discussed in this section.

The study started with my intention to understand the pandemic from the perspective of data analytics and the information technologies (IT) deployment for containment purposes. With the background in information systems, I drifted toward health informatics as a new research area (Mettler et al., 2012). Initial evidence of the pandemic's cases and mortality came from the open source Git Hub databases and geographical information systems that process these data and display it on convenient dashboards (e.g., Johns Hopkins University). Other sources help in completing and validating the data (Worldometers, WHO's statistics, and Bhatia & Minute Physics' visualization site).

As for responses to the pandemic, publicly available sources of both academic and non-academic origins

supported the study. The observation period was January-May 2020. The preliminary research model in Figure 2 depicts the initial research assumptions of the study. The model relates nascent pandemic containment strategies to pandemic outcomes. An assumption was that a differences in strategies could correlate with pandemic outcomes. Empirical observation of both the differing public health measures applied across countries and the pandemic casualties gave rise to this assumption.

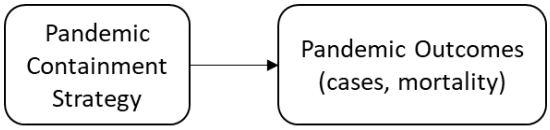

Figure 2. Preliminary Research Model

The study was designed as exploratory in character, and it addressed this research problem:

- How do countries respond to the COVID-19 pandemic caused by the largely unknown and dangerous virus SARS-CoV-2?

The research problem was investigated via the following research questions:

1. What public health policy measures are deployed in different countries, which can be used for creating a model of containment strategy for the COVID-19 pandemic?
2. Can a model of pandemic containment strategy differentiate between particular strategies?
3. What are the key situational and contextual aspects surrounding pandemic containment strategies?

The study was limited geographically to several Asian countries at the center of the epidemic, a part of Western Europe, and North America. The rationale was that these areas have been the birth place of typical pandemic containment strategies.

Due to the simultaneity of the evolving phenomenon and the investigation of it, data collection intertwined with a mixed-method analysis. Potential variables (dimensions of pandemic containment acts) evolved during the research process via a continuous review of evolving literature and iterative coding.

As for the terminology deployed, the term "strategy" refers to a mix of deliberate and emerging goals, plans and ad hoc decisions (altogether, policies) created by health and government authorities. The labeling of the strategies denotes a variation in "forcefulness" of different strategies, with no political or other connotation intended.

3. Findings: PCS Model and Three Strategies

This section discusses findings on pandemic containment efforts exerted by the government and health authorities in the sampled countries. These dimensions gave rise to a model of pandemic containment strategies (the PCS model), which will be introduced subsequently.

3.1 Pandemic Containment Policies

Declaring Special Regime. This dimension emerged from the China evidence (Kupferschmidt & Cohen, 2020; Lai e al., 2020; Myers, 2020; Wu & McGoogan, 2020) and was confirmed in other countries (e.g., those in West Europe that were badly hit in the first wave). It refers to invoking special legislation in

extraordinary circumstances aiming at mobilizing social forces and resources toward containing the COVID-19 pandemic. A special regime can be in the form of a national state of emergency (China), national health emergency (USA), and an ad hoc legislation on granting special powers to the executive branch of government (some European countries). This aspect is related to all other aspects in the PCS model.

Police/Military Enforcement. This dimension refers to an official deployment of state organs of force, typically the police and possibly the military. Declarations of special regime published on government websites provide evidence on this aspect. Police and military can be authorized to enforce restrictions, such as the lockdown and social distancing. The police ordinarily welds discretionary power in maintaining public order, but in a special pandemic regime its authority can be increased (for example, enforcing testing for infection or performing curfew). Some form of police involvement has bee universal. However, when the military gets directly involved in civic life with discretionary powers, this represents a significant change in public life. The military deployment has been limited to a number of countries (e.g., China, Italy, South Africa).

Technology Enforcement. This dimension captures the deployment of modern digital technologies in fighting the pandemic by monitoring citizens' behavior (e.g., social distancing, lockdown measures, early detection of infections). Authorities have used smartphones, wristbands, CCTV systems, and drones for monitoring citizens' behavior and compliance with measures of containing the COVID pandemic (Ahn, 2020; Ghaffary, 2020). High-tech was used also for contract tracing. However, due to the importance of contract tracing in battling COVID-19, it is conceived as a separate dimension, while high tech-enforced contract tracing is framed as the highest extent of contact tracing. While technology-enforcement has been readily and extensively used in the Far East, Western countries have usually struggled with these practices. Exceptions are those that legislated tighter restrictions, such as Italy (France 24 Live News, 2020).

Early Detection. This dimension refers to a government-imposed checkups in order to identify and isolate infected persons. Even before COVID-19 grew into a pandemic, this method was applied in South Korea, Singapore, and Taiwan (Ahn, 2020; BBC/a, 2020; Kupferschmidt & Cohen, 2020). Checkups were performed on airports, bus and train stations, streets, shopping malls, etc. Simulation models found this aspect to make a significant difference in reducing outbreak outcomes (Lai e al., 2020). Some countries, have enabled early detection practices by regulations of a special regime and relied on digital technologies (Ghaffary, 2020).

Contact Tracing. This dimension refers to using manual or automated methods for determining networks of infection from a person tested positive to the persons that he/she contacted. Just in Wuhan, 1,800 teams worked on contact tracing relying on technological means (Kupferschmidt & Cohen, 2020). In South Korea, Taiwan, and Singapore, the virus carriers have been treated as the person of interest in police investigations. Contacts that such a person made were meticulously traced in order to access them for infection testing purposes. In conjunction with the early detection, contact tracing has been considered a key to successful containment of the pandemic in the Far East, and it was enforced by high-tech (Ahn, 2020). In contrast, Western countries have shun away from this sort of intervening into the private space during the first wave of the pandemic. Where it was more regularly deployed (e.g., Germany), contact

tracing relied on the telephone and paper trail. In the US, contact tracing was sidetracked from the point of massive return of Americans from China and Europe, which could have been responsible for the subsequent rampant surge of COVID-19. In technologically challenged parts of the world, contact tracing was performed in a manual manner.

Social Distancing. This dimension refers to a government's advice or lawful orders to maintain a physical distance from other persons. Government websites in the sample studied provided basic evidence on the deployment of this pandemic containment practice (e.g., CDC, 2020). Social distancing have been applied to shared public spaces (streets, parks), stores, restaurants, public transport and workplaces, where a prescribed physical distance is supposed to be maintained between individuals sharing the same space. As well, schools' moving to distance education and closing of pre-school institutions were the instruments of separating members of younger age groups from one another. The cancellation of mass events (sport, arts, entertainment, funerals) added to social distancing measures. Simulation modeling found this aspect to make a significant difference in reducing outbreak outcomes (Lai et al., 2020). In the Far East, social distancing has been enforced by digital technologies (Ghaffary, 2020).

Lockdown. This dimension refers to limiting freedom of citizens' movement by the government decision. This is a compound dimension whose specific facets include ordering/advising citizens to stay at home, quarantining (at home, in a state-run institution), curfew (in various extents), public transport reduction or suspension, and traffic limitations. In some countries, the term "lockdown" is used in a generic sense approximating the term "pandemic strategy" used in this study. Consequently, evidence suggests variation in labeling specific lockdown measures. For example, "stay at home order" uttered in North America may be synonymous with "mandated quarantine" in some European countries. This study, however, treats these two as distinct policy measures.

In most Western countries, both the quarantining and stay at home policies have been implemented. Also, the assumption is that each varies across countries. For example, the "stay at home order" in the USA or Canada is factually an advice compared with such an order in Singapore where it is reinforced by a fine. Likewise, the quarantine aspect may be differentiated based on the location and/or age (e.g., in Serbia, persons over 65 years of age had to stay at home at all time). Lockdown is related to Social and Business Limitations, and it can be enforced by digital technologies.

Borders Closing. This dimension refers to banning entry to the geographical space of a country, with the active involvement of borders guards. Government websites provides evidence on this containment measure. Typically, the travel ban has applied to foreign nationals, while returning nationals were monitored at the entry point and ordered to undergo timed self-isolation – a form of social distancing applied in Canada, among other countries. Since policy on closing borders has usually exempted commercial cargo traffic (e.g., within the EU), this exemption should not be accounted for in assessing the extent of Borders Closing.

Business limitations. This dimension refers to limiting business hours or closing businesses by a government decision. Government websites and press have provided evidence on this dimension that complements the restrictions on individual freedoms. Service businesses facing customers (dentists, beauty saloons, bars, diners, branches of retail) have been the first on the list of closures. For example,

stores and restaurants in Wuhan were closed down, while in other countries their operation was limited to delivering take-out orders. Limitations on business hours has also been used as a policy measure. Offices and factories were shut down in some countries, while not in others. Working from home has been encouraged in many countries in order to support policies on social distancing. Limitations on business have varied up/down with the pandemic progresses. Business Limitations is likely to be related to Lockdown and Social Distancing.

3.2 Model of Pandemic Containment Strategies

The policies discussed above were used for creating a model of Pandemic Containment Strategy (PCS Model). It is depicted in Figure 3. Grouping of the dimensions/variables is based on their domain. The three independent variables in the middle rest in the government domain. Those four on the left represent mass social practices, and the two on the right pertain to the health authorities. Variables within each domain are assumed to be related in some patterns.

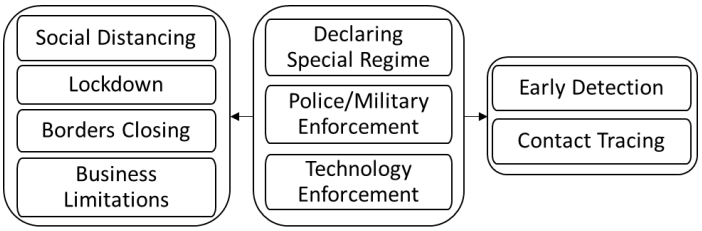

Figure 3. Model of Pandemic Containment Strategy

All the dimensions in the PCS model share logic of control, limitations or restrictions of freedom of movement and conducting business – *forcefulness* as a unifying concept. During 2020, a concept and measurement of "government stringency" surfaced (one source of these data is in the Git Hub database). It is to be noted that the PCS model shares the basic idea with that concept, while having a much broader scope. Furthermore, if the dimensions of the PCS model are assumed to be additive, their ratings allow for creating a single number that indexes a strategy of a particular country or a state within a country along a forcefulness continuum – the PCS Index. These findings answered the first research question.

3.3 Three Pandemic Containment Strategies

In investigating the second research question, dimensions of the PCS model were rated for the sampled countries. Facets of the dimensions and scales appear in the Appendix. The rating step resulted in a wide range of PCS Index scores (3-33) as shown in Tables 1 and 2.

Results of ratings for sampled Far East countries appear in Table 1, while such results for particular countries (or states) in West Europe, US, and Canada appear in Table 2. Table 1 also shows the scales used and weights ("WGT") applied to certain variables on the basis of their evidenced importance in fighting COVID-19.

Table 1. PCS Index Scores and Totals for Far East Sample

COUNTRY/STATE	China, Hubei	Singapore	South Korea	Taiwan	Japan
Population million (M); Density/km2	58.5M; 310	5.6M; 8,360	51.6M; 515	23.8M; 652	126M; 347
1. Declaring special regime (Scale 1,2,3)	*3*	*2*	*2*	*2*	*2*
2. Police/Military enforcement (Scale 0,1,2)	*4*	*1*	*1*	*2*	*0*
3. Technology enforcement (WGT x3) (Scale 0,1,2); beyond contract tracing, monitoring via CCTV, drones	*6*	*6*	*6*	*6*	*1.5*
4. Early detection of infection (Temp. check, questioning, quick tests) (WGT x2) (Scale 0,1,2);	4	4	3	4	1
5. Contact tracing (WGT x2) (Scale 0,1,2)	4	4	4	4	2
6. Social distancing (WGT x2) (Scales 0,1,2)	4	3.2	2	0.5	3
7. Lockdown (Scales 0,1,2)	4	2.3	2.3	2	1.3
8. Borders closing (Scale 0,1,2)	2	2	0.5	1	1
9. Business limitations (Scale 0,1,2)	2	1	1	0	0
PCS Index	***33.00***	***25.53***	***21.83***	***21.50***	***11.83***

Table 2. PCS Index Scores and Totals for West Sample

COUNTRY/STATE	Sweden	Norway	Quebec, CA	Calif., US	UK	Germany	France	Italy
Population million (M); Density/km2	10.2; 25	5.3M; 15	8.6M; 6	39.5M; 98	66.6M; 275	83M; 234	67M; 122	60.4M; 205
1. Declaring special regime	1	2	2	2.5	2.5	2	2	3
2. Police/Military enforcement	0	1	1	1	1	1	2	4
3. Technology enforcement	0	0	0	0	3	3	6	6
4. Early detection of infection	0	0	1	0.5	0	0	0	2
5. Contact tracing	0	2	0	0	0	4	2	2
6. Social distancing	2	3.2	3	4	2.8	3.2	4	4
7. Lockdown	0	2	0.67	1.33	0.67	2	3.5	4
8. Borders closing	0	1	1	0.5	0	0.5	1	2
9. Business limitations	0	2	1.6	1.75	1.5	1	2	2
PCS Index	***3.00***	***13.20***	***10.27***	***11.58***	***11.47***	***16.70***	***22.50***	***29.00***

The absolute range of PCS Index scores is 1-33 (there is no zero point because the dimension "Declaring special regime" ranges from 1-3 since some sort of government act was identified in each country sampled). The range fits the familiar scaling into the low, middle and high ranks, with the corresponding segments being the scores 1-11, 12-22, and 23-33. Invoking the construct of strategy forcefulness, these segments appear to be representative of three strategies of containing the pandemic – *Permissive*, *Hybrid*, and *Restrictive*.

The Permissive Strategy (range 1-11) was applied in Sweden, Quebec in Canada, California in the US, the UK, and Japan (bordering with Hybrid Strategy). The Hybrid Strategy (scores 12-22) was applied in Taiwan, South Korea, Norway, Germany, and France (nearing the Restrictive Strategy). The Restrictive Strategy (Scores 23-33) was applied in China, Singapore, and Italy. Each is discussed more below.

The *Restrictive Strategy* features high limitations on freedom of movement and on business as well as a strong government lead in policy making and reinforcement (note the high ratings in Table 1). It engages

a state of national emergency and deploys the police and possibly military in reinforcing the policies. Authorities engage in close tracing of contacts of infected persons in order to access potential virus carriers. Various means are used to this end, including advanced digital and mobile technologies. Quarantining is forced onto different levels, from the city down to the family level. In China, the Restrictive Strategy has been efficient, taking about three months to contain COVID-19 (the state of emergency in Hubei lasted from January 23 till April 7).

A massive mobilization of human and material resources in China resembled a state of war. Two dedicated hospitals were built in Wuhan in about a week, health care workers from all over China poured to the city, and massive contact tracing was deployed (Kupferschmidt & Cohen, 2020). Some other countries in Asia, Europe, and Africa have followed this strategy. One contextual factor to be noted is the scale of things inherent to China. Wuhan numbers 11 million inhabitants, which is a mid-size city in the Chinese terms, while equaling the size of some countries in Europe. In smaller countries, this strategy emerged either as a consequence of a permissive approach to the pandemic in the beginning (Italy, France) or limited health care resources.

The *Permissive Strategy* implies lower limitations on freedom of movement and business. Authorities rely on behavioral advice and on citizens' voluntary compliance. Pandemic policies are being added and adjusted in accord with the evolving situation. Examples are variation in Social Distancing (the number of people allowed together, locations, occasions), borders control, traffic reductions, business hours regulation, the scope of testing, and the use of facial masks. While the Restrictive Strategy declares a state of national emergency, the Permissive Strategy deploys somewhat softer legal framework. In general, it is low across a number od the PCS dimensions. The border closing may be country-specific, such as within Europe.

The *Hybrid Strategy* imposes mid-level limitations on freedom of movement and doing business (Chang, 2020; Choudhury, 2020), giving an impression as if not much has changed in public life (Blackwell, 2020). It combines some policies typical for the Restrictive Strategy (e.g., close contract tracing, mandated quarantine for infected persons as well as self-quarantining of for contacts) with a more liberal approach to regulating physical movement and business. This strategy appears comparable to the Restrictive Strategy in terms of efficiency and effectiveness. Death rates have been much smaller than those in countries following the Permissive Strategy.

In summary, the dimensions in the PCS model were assessed in a manner that provided an initial validation of the model's capability to differentiate between three containment strategies. They are differentiated on the extent of strategy forcefulness.

4. Findings on Health Care System Capability and Government's Timing

This section reports on findings related to the third research question addressing situational and contextual aspects of the pandemic containment strategies.

The investigation relied on the evidence on medical aspects that have played a role in containing the pandemic. For instance, the testing timing and scope, and the availability of specialized equipment proved

to make a difference in the outcomes of the pandemic. Evidence suggested that a more capable health care system in the Hybrid Strategy countries helped to mitigate outbreak outcomes. In contrast, Italy and Spain showed, rather dramatically, pandemic effects in the context of a less capable health system. There were insufficient hospital capacities, a lack of testing kits, personal protecting equipment and intensive care equipment, while case mortality soared beyond 10% in the first wave of the pandemic (Sills & Millan, 2020; Speciale et al., 2020).

Evidence from France, UK and the US was consistent regarding the hospitalization challenges and death rates. Perhaps the most remarkable indicator of a lacking preparedness was that even health workers in the Permissive Strategy countries could not defend themselves against COVID-19 (Minder & Peltier, 2020). Exceptions in the sample West European countries are Germany and Norway, which followed the path of Hybrid Strategy. In particular, Germany demonstrated a higher capability in the test timing and capacity, and managed a significantly smaller death rate. All this evidence points out to impacts of health care systems in the pandemic as an important contextual factor.

4.1 Government's Response Timing

An early intervention in preventing and controlling any pandemic is as important as heedful preparations for a war. Lai and associates (2020) found that "early detection and isolation of cases was estimated to prevent more infections than travel restrictions and contact reductions". Had China implemented such containment measures earlier, the COVID-19 outbreak could have been significantly reduced in the magnitude and geographical range. Likewise, had the authorities delayed even more the response, the pandemic would have been far worse (Lai et al., 2020). According to some sources, the first cases of COVID-19 appeared in November 2019 (Bryner, 2020; Ma, 2020). Subsequently, infections escalated from 180 (December 27, 2019) to 381 (January 1, 2020), while Wuhan’s health authorities cited just 41 as late as January 11 (Ma, 2020). Many countries provided a similar evidence when overwhelmed hospitals and infected staff revealed a latency in responding to the outbreak. Consequently, a dimension of Response Timing was created to represent another influencer of pandemic outcomes.

A detailed discussion on estimating Government Response Timing are in Travica's (2020) report, so this is just a brief recollection of it. It is sensible to assume that the start date in measuring the government response is January 23, 2020. That is when the WHO announced that the new respiratory disease detected in Wuhan could transfer between people, and it came a day after the Chinese government imposed tight restrictions on Wuhan and surrounding cities. Compared to this date, China's neighbors applying the Hybrid Strategy provided a swift response. South Korea, Singapore and Taiwan detected the first cases on January 23 or 24, and Japan did so on January 26. The sampled Western countries, however, started reporting COVID-19 cases only a month later; the UK and the US were at the end of the lineup in the beginning of March.

Another measure in my study focused on the official reporting on the first caseload hike (a daily increase of 100 or more confirmed cases relative to the previous day). The shorter the period, the latter the response to the pandemic because it comes when the outbreak is already underway; and the opposite is true. For the four Asian actors, this period was between 4-6 weeks, while for the Western countries it was just 3-11 days. This measure corroborates the fact that the West had a late start. These findings warranted

a conceptualization of government's response timing as an important situational factor surrounding pandemic containment strategies.

5. Cultural Foundations of Containment Strategies

Why did the three different strategies emerged during the first wave of the COVID-19 pandemic? The Far East countries were the pandemic originated, had plans for fighting respiratory epidemics that emerged from experiences from fighting the avian flu (H5N1) and SARS. The Western countries had their share in respiratory epidemics, including swine flu (H1N1) and MERS. Overall, the world has been exposed to several respiratory epidemics in the past two decades. National centres for infectious diseases and the WHO have become hubs of institutional knowledge and preparedness strategies. Still, it appears that COVID-19 took the world (with a few exceptions) by surprise. Why so? While awaiting research to shed light on the puzzle, solid investigative journalism and personal accounts of Western travelers who experienced containment measures in the Far East (both sources cited elsewhere in this report) may lead the way.

Journalists reported on successes of say, South Korea, while usually doubting the applicability of Korea's measures in the West. Travelers were usually impressed. Evidence on the struggle between authorities and citizens in Western countries over the emergency-related restrictions corroborated these leads. Confrontations over mask wearing, the police and military enforcement of reduced freedoms of movement and gathering, contact tracing and other measures indicated cultural limits of containment efforts. It appeared that culture set limits to arbitrary, pragmatic choices whenever the authorities would try these out. This line of reasoning led to positing that culture may ultimately be in the background of different pandemic containment strategies. The following conceptual argument will support thesis and complete answering the third research question.

4.3.1 Individual Freedoms vs. Social Responsibility

The Restrictive Strategy puts collectivistic or communitarian cultural beliefs and behaviors before the individual (Hofstede et al., 2010; Trompenaars & Hampden-Turner, 1998). So for example, in the current COVID-19 pandemic, a person wears a mask in order to protect others from being infected by him/her. This behavior is not natural in a culture espousing the Permissive Strategy that puts the individual above the collective and thus focuses on protecting the individual first. A "sense of responsibility and collective action" pervades in a collectivistic culture, as noted by an international team of experts that evaluated China's response to the outbreak (Kupferschmidt & Cohen, 2020).

At the social group level, the Restrictive Strategy presupposes the interest of protecting a nation to interests of smaller social units (administrative localities, economy sectors, religious congregations, etc.). For instance, religious services are promptly banned across denominations. In contrast, the Permissive Strategy addresses the freedom of religion practice more carefully and at the advisory level. While the faithful people may be appreciative of such a policy, church masses and burial ceremonies become sources of infection (Parke, 2020). Negotiations, power struggle and dynamic policy adjustments are the whole mark of the Permissive Strategy. Contrary, a staple of the Restrictive Strategy is centralized decision making and policy creation..

The Permissive Strategy prioritizes individual freedoms. This sets the bar for the extent of limitations on free movement, early detection of infection, contact tracing, wearing facial coverings, and possibly other policy measures. Control power of information technologies is being curbed by concerns of privacy advocates in the USA. Alerts sound when Apple and Google try to develop a system using the smartphone and Bluetooth software for tracking the people that come close to the smartphone's owner and become identifiable by their exposure to the infection (Ghaffary, 2020). In contrast, the Restrictive Strategy deploys intensively such technologies. Implicitly, it presupposes national interest to individual freedoms. The Hybrid Strategy is in agreement with this approach since collectivistic values still make a salient part of cultures in South Korea, Singapore, and Taiwan (cf. Hofstede et al., 2010).

The Permissive Strategy acknowledges that the official social hierarchy must be voluntarily accepted and held accountable, when attempting to impose new limitations on citizens; otherwise, the power relationship breaks down. With the Restrictive and Hybrid strategies, however, legitimacy of social hierarchy is a given. This cultural aspect can also be understood in terms of Hofstede's power distance – the expectations and the acceptance of an unequal distribution of power in society. According to his measurements, most Western countries are lower on power distance, while the Asian countries of interest here are high on this dimension (Hofstede et al., 2010). The implication of these differences is that the Western citizen is typically less willing than the Eastern counterpart to accept the government dictum in the pandemic situation. Japan's falling on the boundary between the Permissive and Hybrid Strategy is an interesting case. While sharing cultural traditions with the neighbors, Japan's long term exposure to Western cultures started with the Meiji Restoration reforms by the end of the 19th century. One outcome is that Japan became more balanced on the collectivism-individualism continuum (Hofstede et al., 2010).

Temptations of freedom during this pandemic have showed up clearly in the case of USA, where the federal and state authorities spurred over the extent of restrictions by taking turns on the pro and con sides. Individual freedoms are purposeful. Being free to "act as one pleases" and engage in "leisurely and fun-related activities" result in the indulgence as another cultural dimension (Hofstede et al., 2010). The USA, as well as most of Western countries, are high on indulgence. Consequently, the government-imposed limitations ranging from a mandated stay at home to protective face masks are counter-cultural, and so the authorities must continuously calibrate the protective measures' level and duration. It should finally be noted that a particular cultural aspect behind the Permissive Strategy may lie in the assumption of a "herd immunity" (Conn & Lewis, 2020) and a related principle of natural selection akin to Social Darwinism, applying the principle of national selection to society (Davis, 2020). Among the countries studied, Sweden and the UK exemplify such a culture.

4.3.2 Trajectories and Importance of Historical Time

Based on empirical investigation, Trompenaars & Hampden-Turner (1998) argued that the American understanding of historical time has been sequential. Think of a resolute process-like, step-by-step progression toward an end-point. This culture is also focused on the present and immediate future and encourages a short future time horizon. These cultural characteristics translate into a pandemic strategy conceived as a process with dated landmarks to be reached in a proximate future. In American culture, the future is assumed to be controllable since each step executed leads to the preconceived end, even though

the obstacles are in a largely unknown natural world. "The future is short-term, something controllable from the present" (p. 134). However, as there are multiple processes in the complex constitution of the American federation, these are rarely in sync and collide more often than not. Power negotiations, power coalitions forming, battling and over-powering are the consequences playing out in the political domain. A zig-zag policy making at various levels of government becomes a landmark in the pandemic situation. At times, the limitations/freedoms see-saw looses a touch with reality and becomes a chip in political games. The Permissive Strategy comes across as a complex and complicated endeavor with uncertain ends, in spite of all the effort of controlling the future.

Contrast these characteristics with the Chinese culture. Shared beliefs are that the past, present and future are equally important and not connected. Add to this a long-term time orientation (Hofstede et al., 2010; Trompenaars & Hampden-Turner, 1998) and nearly three times smaller indulgence than the Americans' (Hofstede et al., 2010). Implications are that the Chinese culture nurtures endurance and patience. These cultural characteristics fit with a pandemic strategy conceived as an uncertain period of unknown longevity, which requires perseverance from everyone.

The Hybrid Strategy combines freedoms with limitations to get the two into a balance that yields desirable pandemic outcomes. Forced quarantining, strict contract tracing enabled by advanced digital technologies, and other new limitations have been pulled out of a SARS rulebook, while there was no general shutdown and a number of businesses continued operating in a special regime (BBC, 2020; Wang et al., 2020). The countries following this strategy harbor national cultures that have mixed Asian and Western beliefs and behaviors since the times of Western conquest until present when the youth is increasingly educated in the West.

There are more cultural similarities than differences between the Hybrid and Restrictive Strategy countries. Koreans and Singaporeans (Japanese, too) believe that the past, present and future are connected. This makes them different from the Chinese culture and similar to Western cultures. However, both the Hybrid and Restrictive Strategy have roots in a similar understanding of historical time as the rewards to present actions are expected in a distant future (somewhat less so in Singapore), which differentiates them from the West. Also, these are collectivistic cultures and they exhibit a higher power distance (Hofstede et al., 2010). They owe common cultural roots to Confucian traditions planted in places where the Chinese people have been in majority or China made impacts through its long history.

Hofstede and associates (2010) argue that people in countries with Confucian traditions "accept and appreciate inequality but feel that the use of power should be moderated by a sense of obligation" (p. 80). In addition, all these countries value the indulgence less than the countries adhering to the Permissive Strategy (Hofstede et al., 2010). These cultural roots may explain why citizens of the Hybrid Strategy countries are willing to accept the limitations imposed by authorities. The membership of Germany and Norway in the Hybrid Strategy group makes an interesting case suggesting that the relationship between the authorities and citizens during a pandemic may not necessarily follow a rigid East-West divide.

Finally, it stands reason that customs surfacing in everyday life also matters. For instance, multi-generational dwelling, frequent group dining, socializing in crowded public places, propensity for large family gatherings, and manners of greeting that include physical contact may be the cultural practices that diminish anti-pandemic defenses and, therefore, necessitate higher restrictions.

In summary, cultural differences regarding national vs. particularistic interest, individual freedoms vs. social responsibility, social hierarchy, power distance, indulgence, and historical time constitute the cultural foundations of the three pandemic containment strategies. The Permissive Strategy is bound to significant uncertainties.

All the findings discussed in this section can be summarized in the comprehensive research model for pandemic management that appears in Figure 4. The model presumes that there is a cause-effect relationship between virus characteristics (e.g., the basic infection rate Ro) and pandemic outcomes (e.g., the effective infection rate Re), while PCS, Response Time, and Health System Capability moderate the relationship (have a mitigating impact). In addition, National Culture influences PCS.

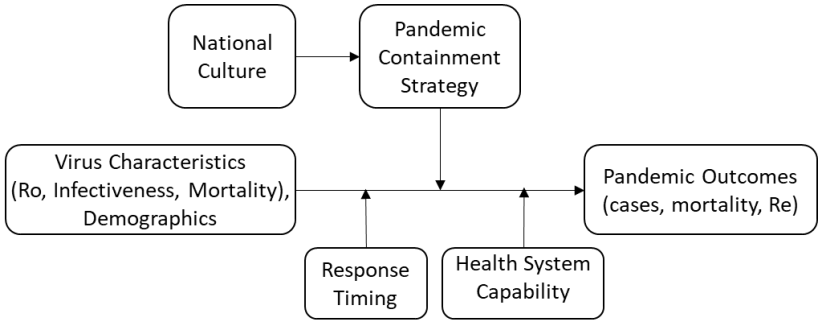

Figure 4. Comprehensive Model for Pandemic Management

6. Discussion and Conclusion

This article reported on the exploratory study of the COVID-19 pandemic first wave in a sample of countries around the world. The study was limited by the available data and by narrowing the sample to Far East, West Europe, and North America. Still, the study's findings on three research questions merit attention.

The first research question addressed policy measures for confronting the pandemic and the investigation established nine variables that further were operationalized into more specific measures. These dimensions served for creating a model of pandemic containment strategy (the PCS model). It brings together governmental enforcements (Declaring Special regime, Police/Military Enforcement, and Technology Enforcement) with effects on both health policies (Early Detection, Contact Tracing) and restrictions of free movement and business (Social Distancing, Lockdown, Borders Closing, Business Limitations).

Rating the PCS variables led to a wide range of PCS scores per country/state scores, thus indexing their pandemic containment strategies. Segmenting the PCS Index scores into a low, middle, and high segments allowed for differentiating between Permissive, Hybrid, and Restrictive strategies. This finding answered the second research question. As for the third research question, the study found a situational factor in the government response time and two contextual factors – the health system capability, and national culture.

All these findings helped to create a comprehensive model for studying the COVID-19 pandemic.

Strategies of containing the pandemic remain the centerpiece in the model. In the sample studied, the Hybrid and Restrictive strategies have been associated with smaller pandemic casualties than the Permissive strategy. The demarcation line between the two camps run along the East-West division, although it is not absolute. In fact, containment strategies are dynamic, evolving with the conditions on the ground. Any pandemic containment strategy brings up limitations to ordinary freedoms. A changing proportion between the limitations and freedoms may indicate dynamics of the strategies.

A strength of each strategy, becomes a liability if the strategy duration and scaling is not properly managed. This is one driver behind dynamics of the strategies. Freedoms that mismatch a changing level or health risk pave the way to worsening of the pandemic. Likewise, restrictions that mismatch the level and longevity of citizens' patience may become unsustainable. Enduring under a prison-like duress takes a high toll as a Wuhan survivor's account demonstrates (Jing, 2020). Equally so, spontaneous descending down a permissive path bear high costs in casualties, as the cases of Italy and Spain indicate.

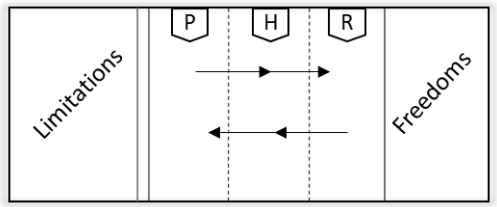

Figure 5. Freedoms vs. Limitations in Containment Strategies
(P=Permissive, H=Hybrid, R=Restrictive Strategy)

Figure 5 depicts dynamics of pandemic containment strategies. The normal proportion of ordinary freedoms and limitations is defined by the double line on the left, while the rest on the rectangle is the domain of freedoms. In a pandemic emergency, the limitations zone expands to the right creating the three pandemic containment strategies (Italy, Spain, and Singapore that probably moved from an early Hybrid to the Restrictive strategy). The boundary of limitations can also move to the left by lifting some restrictions. The result can be either staying within the set strategy (common to all country/state strategies studied) or moving to a less forceful strategy (China).

Future research needs to validate further the PCS model, test in on larger samples, and expand by using the comprehensive research model of pandemic management. This may contribute to understanding the unique challenges that COVID-19 represents and possibly other prospective zoonotic respiratory outbreaks.

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APPENDIX

PANDEMIC CONTAINMENT RATING TEMPLATE
COUNTRY/STATE
Population mill.; Density/km2
1. Declaring special regime (Scale 1,2,3)
Type
L=1: Special new decrees (e.g., quarantine with fine)
M=2: National/State health emergency (US)
H=3: National/State emergency (CH)
Force
L: Advice-Order
M: Order with fines
H: Activate special law; New decrees by Gov't
Mean
2. Police/Military enforcement (Scale 0,1,2)
L=0, Police's regular svce a bit modified
M=1, Police playing active role (breaking crowd, check points)
H=2, Police patrols streets
Military (No=0, Some/Reserves=1, Extensive=2)
Mean
3. Technology enforcement (WGT x3) (Scale 0,1,2); uses beyond contract tracing, monitoring behavior via CCTV,
No=0
Some=1
Significant=2 (e.g., Tech used, privacy intrusion)
Weighted Mean
4. Early detection of infection (Temp. check, questioning, quick tests) (WGT x2) (Scale 0,1,2);
Airport check (No=0, Some=1, Yes=2)
Bus/railway stat. check (No, Some, Yes)
Shopping mall check (No, Some, Yes)
Street check (No, Some, Yes)
Weighted Mean
5. Contact tracing (WGT x2) (Scale 0,1,2)
L=0: Small, no new measure
M=1: Some, no policy, old methods
H=2: Extensive, policy, technology-enforced (privacy intrusion)
Weighted Mean
6. Social distancing (WGT x2) (Scales 0,1,2)
Stay at home extent (No=0, Some=1, Total=2)
Mass events cancelation (No=0, Some=1, All=2)
Biz closing-Work at home (No=0, Partial=1, Yes=2)
Schools closing-Distance edu (No=0, Partial=1, Yes=2)
Nursing homes access limits (None=0, Partly limited=1, Total limit=2)
Weighted Mean
7. Lockdown (Scales 0,1,2)
Quarantine for all mandatory (None=0, Short=1, Long=2)
Quarantine for sick/suspected (No=0, Home=1, Institution=2)
Curfew (None=0, Some=1, Prolonged=2)
Mean
Passenger traffic international limits (No=0, Selective=1, Total=2)
Pass. traffic limit in country (None=0, Intercity=1, Within city=2)
Mean
Means Sum
8. Borders closing (Scale 0,1,2)
Country (No=0, Some=1, Yes=2)
States in country (No=0, Some=1, Yes=2)
Mean
9. Business limitations (Scale 0,1,2)
Retail: (No=0, Partial=1, Extensive=2)
Restaurants: (No=0, Some=1, All=2)
Pers. Services: (No=0, Some=1, All=2)
Factories (No=0, Some=1, All=2)
Mean
PCS Index