Responses to COVID-19: The role of governance, healthcare infrastructure, and learning from past pandemics[☆]

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A R T I C L E   I N F O

A B S T R A C T

The ongoing COVID-19 outbreak has revealed vulnerabilities in global healthcare responses. Research in epidemiology has focused on understanding the effects of countries' responses on COVID-19 spread. While a growing body of research has focused on understanding the role of macro-level factors on responses to COVID-19, we have a limited understanding of what drives countries' responses to COVID-19. We lean on organizational learning theory and the extant literature on rare events to propose that governance structure, investment in healthcare infrastructure, and learning from past pandemics influence a country's response regarding reactive and proactive strategies. With data collected from various sources and using an empirical methodology, we find that centralized governance positively affects reactive strategies, while healthcare infrastructure and learning from past pandemics positively influence proactive and reactive strategies. This research contributes to the literature on learning, pandemics, and rare events.

1. Introduction

From the bubonic plague in the 6th century Byzantine Empire to smallpox, which claimed more than 20 million lives, cholera, and Spanish flu, which infected more than 500 million people globally, pandemics have been a major source of disruption in the social, political, and economic environment of many countries (Leung et al., 2020). On the positive side, learning from the effects of pandemics has guided the global health community in understanding the important role of vaccination in preventing future outbreaks. In recent history, pandemics such as SARS, swine flu, HIV, Ebola, and MERS weakened the global economy (Smith Richard et al., 2011), although the consequences of some of these pandemics were largely limited due to an increase in public health responses by global organizations. Nevertheless, the panic caused by such pandemics highlights that countries should ensure that additional public health measures are in place to allow them to respond faster in future[1].

The ongoing outbreak of the novel coronavirus SARS-CoV-2, which causes a disease known as COVID-19, has revealed vulnerabilities in the global community's response to virus outbreaks. While both global authorities and individual countries have made efforts to contain COVID-19, as they have done with other pandemics in the past, the question remains whether short-term measures (quarantining, social distancing, etc.) are a sufficient response to pandemics or if we need to be more proactive.

Academic scholarship has also started focusing on the multiple challenges associated with COVID-19. From uncertainty in the business environment (Sharma et al., 2020b) and supply chain disruptions (Sharma et al., 2020a) to issues such as gender equity (Leung et al., 2020), the extant literature has been proactive in exposing vulnerabilities, identifying causes and concerns, and providing solutions to issues raised by COVID-19 (see Journal of Business Research special issue on 'Covid-19 Impact on Business and Research')[2]. Accordingly, scholars have been addressing issues pertaining to both the business and societal outcomes of pandemics, highlighting a few key insights; for example, macro-level factors such as public health expenditure (Leung et al., 2020) and governance structure (Obermann et al., 2008) affect public health outcomes, such as in terms of the number of tests conducted, diagnostics, and active and critical cases (Leung et al., 2020).

However, the existing research in this field suffers from two limitations. First, there is disagreement among scholars about the relationship

between the macro-level factors in mitigating the effects of a pandemic. For example, in focusing on the role of governance, some scholars argue that a centralized governance structure has a positive effect on the pandemic response and subsequent outcomes, while others contend that a decentralized structure has a more positive effect (Schatz and Berlin Jr 2011; Jiang et al., 2020). Such findings are problematic as they not only create theoretical paradoxes but also constrain managerial and government action during pandemics. Second, empirical research has also suggested that macro-level factors may have a differential effect on public health outcomes. For example, Leung et al. (2020) showed that public health expenditure, while having a positive effect on the number of diagnosed and critical cases associated with COVID-19, has no effect on the number of active cases, deaths, and tests conducted. Therefore, there is a lack of consensus among scholars about both the nature and direction of the relationship between macro-level factors and public health outcomes during pandemics.

To address these research gaps, in this paper, we draw on the literature on rare events (for an existing review of rare events, see Lampel, Shamsie and Shapira, 2009), which suggests that countries can adopt a reactive strategy (solve the immediate problem) or a proactive strategy (early detection of a disease) to mitigate the challenges associated with rare events. Hence, we examine the role healthcare infrastructure (Leung et al., 2020), governance structure (Obermann et al., 2008), and whether countries have faced similar pandemics before on their utilization of both reactive and proactive strategies to combat COVID-19. The specific research questions of our study are:

RQ1: Do governance structure, healthcare infrastructure, and learning from previous pandemics assist a country in combating the COVID-19 pandemic?

RQ2: Is there a differential effect of governance structure, healthcare infrastructure, and learning from previous pandemics on adopting reactive vs. proactive strategies?

Leaning on the literatures of organizational learning (Crossan et al., 1999) and rare events (Lampel et al., 2009), we propose links between governance structure, healthcare infrastructure, and learning from previous pandemics and the response (i.e., reactive and proactive strategies) to COVID-19 and provide a conceptual framework. Reactive strategies in disease control are defined as those that are implemented upon detection of disease, whereas proactive strategies are those used to identify whether a disease is prevalent in a population (Smith, Cheeseman, Clifton-Hadley, & Wilkinson, 2001). In this study context, we consider the number of people recovered as an indicator of a reactive strategy as it is based on the treatment patients receives after COVID-19 has been detected. We consider the number of tests conducted as an indicator of a proactive strategy. Recent research on COVID-19 has highlighted that testing patients can be considered a proactive strategy as it is aimed at identifying prospective patients who may be carriers (Wang, Ng, & Brook, 2020). Through secondary data collected as of April 12, 2020, and using a robust empirical analysis, we test our hypotheses and show the relationship between governance structure, healthcare infrastructure, and experience from prior pandemics and reactive and proactive strategies.

This paper makes several contributions to the extant literature. First, for the organizational learning literature, we show that while existing routines may not be effective during pandemics, investment in healthcare is still effective as it may facilitate quick adaptation, thus enhancing the response to a pandemic. Second, we highlight the role of governance structure in providing proactive and reactive responses to COVID-19 and thereby offer a resolution to the debate in the literature surrounding the paradoxical claims about the role of governance in the management of pandemics. Third, in relation to the literature on rare events, we explore three macro managerial factors that may affect a country's response to COVID-19 in addition to the clinical and vaccine-related factors. In

terms of policy development, this study discusses how a country should govern its policies to combat the negative effects of pandemics. Finally, for humanity, this study explores the macro managerial factors that may help a country enhance recovery and reduce deaths, thereby providing strategic recommendations for changes in policies. In the next section, we discuss the conceptual background.

2. Conceptual background

Research on learning has argued that learning in any system is multidimensional in nature, incorporating multiple levels – from individuals to an overall system, such as an organization (Crossan et al., 1999) or a country. Learning is a dynamic process, and before it is institutionalized, it must go through a process of intuition, interpretation, and integration (Lawrence et al., 2005). While intuition and interpretations are individual-level processes of learning, integration occurs at the group level, and institutionalization takes place at the system level. Specifically, once individuals develop an interpretation of a phenomenon through shared practices, shared understanding, and negotiation, they start integrating the new learning as a part of the collective consciousness (Crossan et al., 1999). Meanwhile, learning for a system, such as a country, is more complex and is embedded not only in an individual or a group but also in systems, structures, routines, etc.

Scholars argue that the institutionalization of learning may take place either through individual or group learning processes (Fong Boh et al., 2007) or through investment, e.g., in infrastructure (Crossan and Berdrow, 2003). Regarding the former, individuals share their knowledge with teams or groups who, in turn, integrate this knowledge at the organizational level and make it institutionalized. The reason why individuals, groups, and organizations are motivated to do so is because of shared goal orientation (Chadwick and Raver, 2015). For example, in the context of healthcare systems, individual doctors seek new knowledge, interpret it, and then share this knowledge with their professional or hospital group. Eventually, these groups assist the health system leaders in institutionalizing the knowledge, primarily because all entities in this process are oriented toward improving health outcomes in society. Similarly, prior research has indicated that new routines become institutionalized with an increase in investment, as this also helps integrate newly developed routines with existing knowledge processes (Zack, 1999).

The institutionalization of learning thus occurs by creating opportunities through which individuals/groups may exercise and repeat the behaviors associated with newly acquired knowledge (Walter, Lechner, & Kellermanns, 2016). Such practices not only create new capabilities within a system (Nelson Richard and Winter, 1982) but also enable individuals/groups in a system that operates in a "semiautomatic repertoires" (Eisenhardt and Martin, 2000). Additionally, new feedback loops are created that help understand the causal relationship between a particular type of behavior and performance (Walter et al., 2016), meaning that as learning improves, individuals can modify their behavior to adjust performance. In the case of COVID-19, such learning may be reflected in investment in healthcare, which has been shown to be a critical factor driving public health outcomes (Leung et al., 2020).

While learning and institutionalization can take place through investment in infrastructure, organizations also learn from multiple environmental factors. In particular, countries can learn from rare events, such as disasters (Christianson et al., 2009), which prior research has shown to facilitate three major sources of learning. First, governments and organizations learn from rare events as multiple stakeholders start sharing information (Altay & Pal, 2014). Second, learning from rare events becomes institutionalized as shared understanding develops, while multiple stakeholders may share different interpretations of the event to "create a mosaic of conflicting lessons" (Labib et al., 2019).

Post-crisis, organizations try to combine the understandings from different internal and external stakeholders to be better prepared in the future (Bundy et al., 2017). These conflicting lessons pave the way for a deeper understanding of rare events that facilitates more institutionalization of the learning. Finally, learning can also take place as there is a variety of perceptions as well as preferred outcomes, leading to the creation of new insights.

Such learning, both from investments in a particular system and arising due to rare disasters, makes a system more flexible, leading to faster responses to new challenges as compared to those lacking such learning (Jiménez-Jiménez and Sanz-Valle 2011). While this learning is vital, prior research has also shown that the type of governance may affect learning (Sorenson & Sørensen, 2001). For example, scholars argue that a decentralized governance structure may broaden the channel of communications and facilitate institutionalization through higher levels of coordination (Van Wijk et al., 2008). Thus, it is also important to understand how the governance structure of a system can facilitate learning.

Leaning on the learning literature, we hypothesize that governance structure, healthcare infrastructure, and learning from previous pandemics affect a country's response to COVID-19. In terms of this response, we consider two outcomes, namely one associated with the recovery of patients (reactive strategy) and the other associated with the number of patients tested (proactive strategy). In the next section, we present our hypotheses. See WA-Table 1 for the related literature and how we contribute to various literature streams.

3. Hypothesis development

3.1. Healthcare infrastructure and responses to COVID-19

WHO measures healthcare spending per country as the total investment in developing healthcare infrastructure, conducting research, and improving access and affordability (WHO 2020), and it can affect organizational learning in three ways. First, increases in healthcare infrastructure help a country to emphasize healthcare experts internally and global health institutions externally. Consistent with the literature that suggests that organizations can lean on internal stakeholders to develop crisis responses via learning (Bundy et al., 2017), increases in healthcare infrastructure can help a country accumulate tacit knowledge about the country from internal experts and embed it within the system. Meanwhile, explicit knowledge about disease control from external experts can support the system in responding to its immediate needs. Furthermore, increases in healthcare investment allow individuals within a healthcare system to use intuition to seek new knowledge, interpret it as per the existing context, and integrate it within the existing system (Chadwick and Raver, 2015). Moreover, increases in healthcare spending allow a country to institutionalize learning (Nonaka, 1994), which positively affects organizational responses during a crisis.

Second, investing in healthcare infrastructure allows an organization to develop a depth and breadth of specialized knowledge that can be deployed as per the requirements (Ryu et al., 2005). Such investment facilitates quick adaptation to changing environmental conditions, thereby positively affecting responses during a pandemic. Increases in healthcare investment allow a country to develop not only physical infrastructure but also human capital (Huber, 1991), which motivates stakeholders (e.g., healthcare professionals) to share knowledge and create unique knowledge within the system. The availability of tacit knowledge, coordination, and complementarity leads to knowledge embeddedness, which positively influences knowledge synergies; these can, in turn, help tackle problems that have no pre-specified solutions (Nielsen, 2005). Hence, not only do routines and protocols exist to deal with outbreaks, but also there is a faster response to a pandemic, which may affect the reactive response to COVID-19. One such example is Taiwan, where high healthcare investments have facilitated not only

information distribution but also the creation of knowledge synergies, such as digital technological systems, to respond effectively to the crisis[3]. Similarly, Germany, with an advance healthcare infrastructure, has utilized telemedicine to provide an adequate response to the COVID-19 outbreak[4].

Third, an increase in investment in healthcare will facilitate the creation of knowledge within the system, which can enhance responses to unknown situations. As investment increases, multiple levels of a healthcare system may integrate learning to support the proactive testing of patients, and the ability to treat them. For example, in Taiwan, the government was able to use health workers and multiple databases, such as the National Health Insurance database, to proactively identify and test patients (Wang et al., 2020) and provide treatment. As such, we argue that countries with healthcare investment can more quickly identify new challenges arising due to a pandemic such as COVID-19 and subsequently better respond to such challenges. We hypothesize the following:

H1a: There is a positive relationship between healthcare investment and a country's reactive response to COVID-19.

H1b: There is a positive relationship between healthcare investment and a country's proactive response to COVID-19.

3.2. Learning from past rare events and responses to COVID-19

Learning from rare events, especially prior pandemics, may also affect the response to the COVID-19 outbreak. Extant research suggests that organizational performance increases when the organization gains production knowledge (Reagans et al., 2005). Specifically, learning from experience can improve organizational knowledge sources, providing individuals within the system the opportunity to benefit from knowledge accumulated by others while also promoting effective coordination and teamwork (Tucker et al., 2007; Reagans et al., 2005). Furthermore, the way organizations perceive the impact of rare events influences their willingness to translate the learning from these events into change (Lampel et al., 2009).

Rare events create a clear motivation to learn lessons and make the necessary operational and cognitive adjustments (Lampel et al., 2009). However, by virtue of being a rare event, not all countries or organizations experience one (Rerup, 2009). For example, SARS was reported in only thirty-two [32] countries, with a mere four countries reporting more than 100 patients[5]. This suggests that learning from a rare event to make operational adjustments differs based on experience. Meanwhile, rare events may lead to the auditing of multiple systems, which creates new learning for actors in the system (Christianson et al., 2009). Learning from the experience of rare events also equips systems to deal with future rare events as they become more robust, and actors become more competent in dealing with interruptions. Contrary to other ways of learning, learning from rare events can be considered as "skills learned during an action", which can be easily transferred to future rare events (Christianson et al., 2009). Research suggests that exposure to multiple unusual experiences helps organizations build narratives around understanding how to respond to such events in the future (Garud et al., 2011). Using multiple diverse individuals who can integrate their interpretation of learning from rare events also creates strong institutionalized learning (Chadwick and Raver, 2015). Similarly, as rare events challenge existing routines, multiple elements of a system face failures, thus allowing individuals and groups to learn more from events that otherwise would have been dismissed as noise (Maslach et al., 2018). Thus, rare events not only yield more diverse learning but also

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[3] https://knowledge.wharton.upenn.edu/article/singapore-south_korea-tai wan-used-technology-combat-covid-19/

[4] https://www.healthcareitnews.com/news/europe/germany-benefits-digit al-health-infrastructure-during-covid-19-pandemic

[5] https://www.who.int/csr/sars/country/2003_07_11/en/

make individuals develop actionable skills that can easily be applied to future rare events (Garud et al., 2011).

However, rare events that attract attention or have a high impact are more scrutinized and are thus more likely to trigger an extensive revision of beliefs and activities; this is termed transformative learning (Lampel et al., 2009). Rare events make the individual actors within a system more vigilant about various signals that they otherwise would have ignored in the absence of rare events (Labib et al., 2019). We argue that countries that have faced major outbreaks of infectious diseases, such as H1N1, MERS, or SARS, learned from these high-impact rare events and, as a result, extensively changed their protocols for preventing such pandemics. One such example is South Korea, which, through contact tracing, was able to contain COVID-19 swiftly. South Korea suffered heavily from a MERS outbreak in 2004, causing the country to develop systems that have proven to be effective in contact tracing[6]. Similarly, the SARS outbreak led to the creation of Emergency Outbreak Centers – a source of learning and knowledge repository, which has helped in effectively responding to COVID-19. Thus, after countries have faced high-impact rare events, they tend to extensively change their protocols and are more likely to deploy proactive strategies.

Rare events that have a low impact on organizations, such as near-misses, often lead to re-interpretive learning, wherein the organization analyzes the potentially serious consequences (Lampel et al., 2009). Thus, even in cases where rare events do not have a high impact, an organization learns and may undertake some form of analysis that touches on multiple systems within it (Lampel et al., 2009). Thus, while countries that face non-impactful rare events can learn from the experience, this learning may not trigger extensive changes to the system, and thus the healthcare system develops more reactive responses. Hence, we argue that increases in learning from prior rare events trigger healthcare systems to transform their operations so that they will be able to respond to future rare events in a proactive as well as reactive manner.

H2a: There is a positive relationship between learning from a past rare event and a country's reactive response to COVID-19.

H2b: There is a positive relationship between learning from a past rare event and a country's proactive response to COVID-19.

3.3. Governance and response to COVID-19

While healthcare investment and learning from past rare events may affect the response to COVID-19, responding to a pandemic requires coordination between multiple stakeholders on multiple levels. The extent of learning within organizations has been shown to be influenced by the governance mechanism that they deploy (Lauer and Wilkesmann 2017). Research on governance suggests that new forms of governing mechanisms are emerging in countries; one such prominent mechanism is decentralization, wherein the central government transfers authority and responsibility for specific tasks to lower levels of government (Nelissen 2002). However, a large number of countries follow an approach wherein the central government conducts programs for the entire country with no modifications for local needs – termed centralized governance (Persson and Tabellini 1994). Research in healthcare has shown that decentralization facilitates local solutions, provides more flexibility, and reduces administrative costs (Obermann et al., 2008). Decentralization also facilitates a faster response to those in need, thus increasing coverage (Lawn et al., 2008). Organizational learning theories, however, argue that decentralization has both advantages and disadvantages (Carley 1992). Nonetheless, in the case of a rare event, it is difficult to ascertain the precise effect of governance structure on the country's response, and pandemic response research

holds multiple views in this regard. Some scholars argue that centralized governance may lead to a negative pandemic response as information may not be dispersed quickly among the people, and governments may not even share information with the people (Jiang et al., 2020; Leung et al., 2020). On the other hand, other scholars suggest that a centralized structure may positively affect the pandemic response because it can mobilize resources, enforce strict restrictions, involve multiple actors, and control the message that needs to be communicated to the people (Schwartz 2012). Finally, there is also research indicating that governance structure may not play an important role during rare events (Bellido et al., 2019).

Research on organizational learning suggests that both centralized and decentralized governance structures have unique benefits and challenges (Carley 1992). Centralized governance facilitates efficient resource allocation and coordination among multiple stakeholders, which is essential for success in a radically changing environment (Aoki 1986). Centralized teams are also better suited to handling complex tasks. In a centralized team, no one person has access to all the information nor the skills to comprehend the problem and make a decision (Carley 1992). In contrast, decentralized structures can provide unique information about changes in the environment (Amin and Cohendet 2000). Furthermore, decentralized teams learn faster and may, therefore, be able to respond more quickly to unusual problems (Carley 1992). As COVID-19 has created unique challenges for governance, we argue that a centralized governance structure will positively affect reactive responses to COVID-19 but hinder proactive responses to the disease.

Centralized governance helps provide a unified response to a pandemic as a hierarchy economizes on the cost of knowledge production by creating a common identity and language among the various stakeholders in a system (Nickerson and Zenger, 2004). Such an identity facilitates not only knowledge transfer but also provides quick responses as all elements in the system start acting in sync. Again, as the systems are governed centrally, it becomes easier to develop routines and protocols that may be essential for responding to the crisis. Finally, prior research has argued that centralized governance is important when there is a high interaction problem (the knowledge set cannot be separated into small sub-problems) (Nickerson and Zenger, 2004). We argue that COVID-19 has presented a high interaction problem, whereby multiple knowledge sets need to come together to create a solution to contain the outbreak (Carley 1992). Again, as the outbreak is progressing at an unprecedented speed, a quick response is vital. Therefore, we argue that:

H3a: There is a positive relationship between a centralized governance structure and a country's reactive response to COVID-19.

However, we also argue that a centralized governance structure may negatively affect proactive responses to COVID-19. Decentralized teams are known to learn faster (Carley 1992), and a decentralized structure reduces information demands and the cognitive workload of individuals, thereby facilitating the assimilation of new patterns and associations (Fiol and Lyles, 1985). This is because a decentralized structure provides bottom-up knowledge, which is essential in searching for new innovative solutions. Proactiveness is also enhanced as decentralization leads to the establishment of early warning signals, which facilitate proactive strategies. We, therefore, argue that:

H3b: There is a positive relationship between a decentralized governance structure and a country's proactive response to COVID-19.

Based on the above discussion, we propose the conceptual framework of the study presented in Fig. 1.

4. Empirical setup

4.1. Data

We collected data from various sources. For the complete list of sources of data, see WA-Section A. We captured the recovery from COVID-19 at the country level from Worldometers, which provides information related to

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[6] https://theprint.in/world/s-koreas-contact-tracing-system-set-up-for-mers-is-helping-it-flatten-covid-curve/408164/
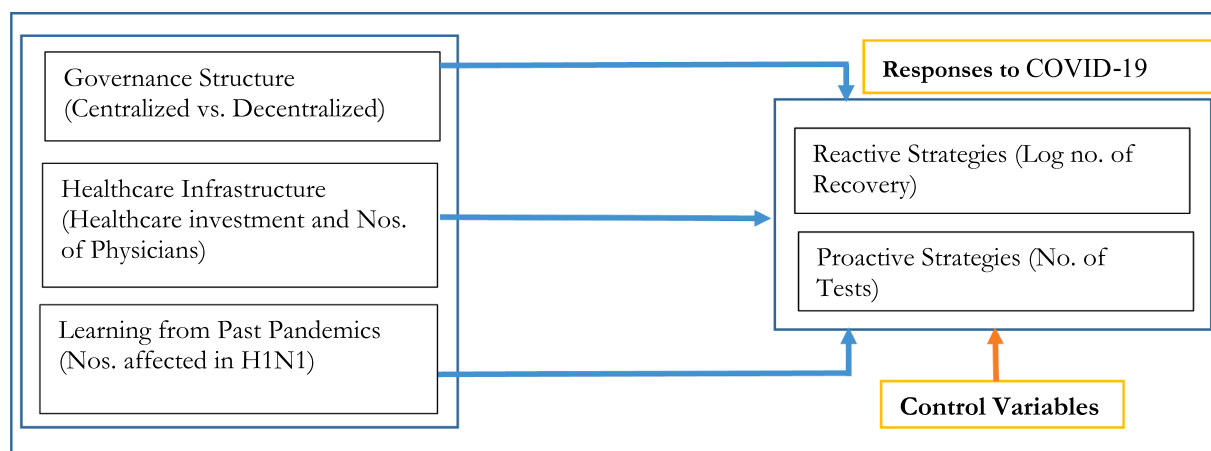
Fig. 1. Conceptual framework.

reported cases and deaths by country, territory, or conveyance. Our data on recovery was accessed as of April 12, 2020. We matched the numbers with other databases, such as ourworldindata.org and Johns Hopkins Coronavirus Research Center as of April 12, 2020, and the numbers reported are largely the same. To determine the governance structure, we first determined the system of government by looking at the constitution of the country where available. We then compared our information with the details provided by the NationMaster database. We also confirmed the country-level governance information by looking at multiple other sources, such as the International Monetary Fund. We collected information on the number of people affected in previous pandemics, such as SARS and H1N1, from the World Health Organization (WHO) database as well as by looking at each country's health ministry information, center for disease control, or similar organizations' websites accessed as of April 13, 2020. For example, for Argentina, we looked at the Ministry of Health's "INFLUENZA PANDÉMICA (H1N1) 2009. REPÚBLICA ARGENTINA". Similarly, we looked at Italy's Ministry of Health archive information page on H1N1 infections. We gathered information about the percentage of the population across various age groups from the World Bank database. Information on the healthcare infrastructure was gathered from the World Bank's World Development Indicators: Health Systems database. We obtained data on insurance infrastructure from multiple sources. For example, we looked at the social security administration of Portugal to determine the type of insurance infrastructure it follows; in this case, the universal government-funded health system. Similarly, to identify Qatar's healthcare system, we looked at an article published in the International Medical Travel Journal, showing that Qatar follows the universal public insurance system. We also used media articles to find the type of insurance infrastructure each country follows. For example, we determined that Kenya follows a non-universal insurance system. We collected information on GDP per capita and population from the World Population Review database. We would like to note that data on healthcare infrastructure, as well as some of the control variables, were not available for the most recent year (i.e., 2019) for some of the countries, and we used the latest data available for each country. We also collected data on the Human Development Index (HDI), which measures the average achievement of a country on three important dimensions: "a long and healthy life, knowledge and a decent standard of living"[7].

4.2. Variable operationalization

Response to COVID-19: We operationalize responses to COVID-19 as the number of recoveries from the disease (e.g., reactive strategy) and the total number of tests conducted as of April 12, 2020 (e.g., proactive strategy).

Governance structure: We operationalize governance structure as centralized vs. decentralized (Amin and Cohendet, 2000). Countries having a system of government such as monarchy, communist or dictatorship are classified as having a centralized governance structure, whereas countries having democratic or republic forms of government are categorized as having a decentralized governance structure.

Healthcare infrastructure: We operationalize healthcare investment in two ways: healthcare expenditure as a percentage of GDP and number of physicians per 1000 population. This operationalization is consistent with the prior literature (Berwick and Hackbarth, 2012). In our primary analysis, we test the impact of healthcare infrastructure using healthcare expenditure as a percentage of GDP as its operationalization.

Learning from previous pandemics: We operationalize learning from previous pandemics using the number of people infected in two previous pandemics, namely SARS and H1N1. Our argument for this operationalization is that if the country experienced more cases in the SARS or H1N1 outbreaks, the country has more knowledge about the best practices and is better prepared to respond to COVID-19. This line of thinking is consistent with the literature on pandemic and healthcare responses to outbreaks (Hoffman and Justicz 2016). We use cases each country experienced for H1N1 in our model as cases for SARS were correlated with other variables.

Insurance infrastructure: We operationalize insurance infrastructure as the type of national insurance used by each country. In this context, we use an existing categorization: universal government-funded healthcare (UGFH), universal public insurance system (Dowding et al., 2000), universal public–private insurance (UPPI), non-universal insurance system (NUIS), and private insurance system (PIS). We operationalize each of these as a dummy variable specific to each country. This classification is consistent with the existing literature. Note that, we could not find information on insurance infrastructure for a few countries. For the categorization purpose, we consider those observations as 0.

Control variables: We collected data on GDP per capita (Chin & Wilson, 2018), population, percentage of the population aged above 65 years, the number of nurses per 1000 population, and the severity of H1N1 (dummy operationalization) (Maslach et al., 2018), which may affect responses COVID-19 or any rare events. We also have information for the country's position on the HDI.

4.3. Model

We estimate the following two models to test for H1a, H1b, H2a, H2b, H3a, and H3b.

$$Recovered_i = \alpha + \beta_1 GovStructure_i + \beta_2 Healthcare\_\%GDP_i$$
$$+ \beta_3 Learningfrompast\_SARS_i + \beta_4 Learningfrompast\_H1N1_i$$
$$+ \sum_k \beta_k\ insuranceinfrastructure_{ik} + \sum_j \beta_j control_{ij} + \epsilon_i \qquad (1)$$

$$Total\_tested_i = \alpha + \beta_1 GovStructure_i + \beta_2 Healthcare\_\%GDP_i$$
$$+ \beta_3 Learningfrompast\_SARS_i + \beta_4 Learningfrompast\_H1N1_i$$
$$+ \sum_k \beta_k\ insuranceinfrastructure_{ik} + \sum_j \beta_j control_{ij} + \epsilon_i \qquad (2)$$

$Recovered_i$ indicates the total number of people recovered[8] in ith country; $Total\_tested_i$ represents the total number of people who were tested in ith country; $GovStructure_i$ indicates whether the country has a centralized or decentralized governance structure (centralized = 1; 0 otherwise); $Healthcare\_\%GDP$ represents healthcare infrastructure in terms of healthcare spending as a percentage of GDP in ith country; $Learningfrompast\_SARS_i$ and $Learningfrompast\_H1N1_i$ represent the total number of people affected by SARS and H1N1, respectively, in ith country, wherein a higher number represents higher learning; and $insuranceinfrastructure_{ik}$ represents jth insurance structure in ith country.

Our estimation of Eq. (1) and Eq. (2) shows that the models suffer from multicollinearity issues. Multicollinearity in our dataset can arise from multiple sources, including inefficient and insufficient data, model or population constraints, presence of definitional relationships, model structure, and over-identification (Grewal et al., 2004; Paul, 2006; Beckstead, 2012). Lack of a sufficient number of observations to estimate a model can create multicollinearity. We do see that our dataset has fewer valid data points that may result in multicollinearity. Our data comes from the country level information where many countries do not report COVID-19 cases and/or do not have information on some of the critical variables used in our model, raising multicollinearity issue (Farrar and Glauber 1967; Ofir and Khuri 1986). In our data, we have a couple of variables that are related to definition wise. For example, the Human development index may be correlated with life expectancy and education index. They may raise collinearity issues. Complicated models (e.g., models with interaction terms) can create multicollinearity. Multicollinearity may also arise due to the presence of a large number of variables to make a model more realistic. In our context, we do have a large number of variables with respect to the total number of observations.

We diagnose potential multicollinearity using correlation matrix and variance inflation factor (VIF). We do find that our proposed models suffer from multicollinearity with the highest VIF for Human Development Index (VIF = 4.62), followed by population aged 65 or above (4.01), and the number of nurses per 1000 population (VIF = 3.48).

Various techniques have been proposed to cure for multicollinearity issue, one of them is to obtain more data. However, given our context, this is not an option. Another approach suggests to transform or scale the variables with the relevant transformations (e.g., square root, cube root, logarithmic, etc.) or scaling. We have tried to scale all the variables (dependent and independent) in our model (excluding binary variables) by the population of each country. However, such a scaling resulted in much higher VIF for the number of nurses per 1000 population (VIF = 29.51), followed by population 65 years old or above (VIF = 27.53), HDI (VIF = 14.17), and GDP per Capita (VIF = 4.03), respectively. Hence, we refrain from scaling[9] all the variables by the population of each country; instead, we control for the population in our model. The third option is to remove the collinear variables. We have dropped HDI, population 65 years and above, the number of infections in SARS, and the number of nurses per 100 population from our models. We consider VIF=<2[10] as

the cut-off point to assume that our models do not suffer from multi-collinnery issue. The re-estimation of the models satisfies our hypotheses, and the highest VIF is for GDP per capita (VIF = 1.73).

5. Results

We present the bivariate correlation and descriptive statistics in Table 1. We present the results of Eq. (1) and Eq. (2) in Table 2. Moreover, we attempted to estimate the models using ordinary least squares (OLS), maximum likelihood estimation (MLE), and generalized methods of moments. The model results with OLS estimation, being comparatively better, are presented here. The results of Eq. (1) (see Table 2, Model 1) suggest that healthcare infrastructure (i.e., healthcare investment as a percentage of GDP (β = 0.2088, p < .05)) is positively related to a reactive response to COVID-19 (i.e., more recovery of patients), supporting H1a. Table 2 Model 2 shows that healthcare infrastructure (i.e., healthcare investment as a percentage of GDP (β = 48814.1700, p < .01)) is also positively related to a proactive strategy (i.e., number of tests done), supporting H1b. We find evidence that learning from the past pandemic experience positively impacts the country's response to COVID-19. Specifically, supporting H2a, we find that the total number of cases of H1N1 (an indicator of learning) is positively related to a reactive strategy (β = 0.0000017, p < .01). Similarly, the total number of cases in H1N1 (an indicator of learning) is positively related to a proactive strategy (β = 0.1842, p < .1), supporting H2b. In terms of the effects of governance structure, we find that centralized governance is positively related to a country's response to COVID-19 in terms of reactive strategies (β = 1.0925, p < .1), supporting H3a; however, we do not find any significant relationship between governance structure and proactive strategy; thus H3b is not supported. We also find that the population of a country and GDP per capita positively influence reactive strategies, and GDP per capita also positively influences proactive strategies.

5.1. Robustness analysis

Controlling the effects of proactive strategies

As the recovery comes after proactive strategy, it is indeed critical to account for the proactive strategies when we expose the effects of governance, healthcare infrastructure, and learning from past pandemics on reactive strategies such that realized show the true effects. We estimated a model with proactive strategies (i.e., total tested) as an additional control variable. As evident from Table 3, we still get the effects of governance structure and learning from past on reactive strategies; however, as proactive strategies are a reflection of healthcare preparedness, we do not see the effects of healthcare investment on reactive strategies.

5.2. Joint estimation

Eq. (1) and Eq. (2) are independently estimated. Although we have shown model results after controlling testing, Eq. (1) and Eq. (2) may still be correlated, demanding a joint estimation (allowing the error terms to be correlated). Table 4 shows the joint estimation results (using seemingly unrelated regression), and we receive directionally consistent results. Note that the results of joint estimation capture if there is any relationship between reactive and proactive strategies that may bias the results.

5.3. Scaling independent variables

In our models, we control for each country's population that may alter the effect of independent variables. However, just controlling may not be sufficient. Hence, in this robustness analysis, we attempt to scale the independent variables. Note that the types of governance is a binary variable; hence, scaling may not be meaningful here. Moreover, healthcare infrastructure of a country is operationalized as healthcare

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[8] We take the log transformation of the variable to bring it to normality.
[9] In a separate robustness analysis, we scale the number of infection from H1N1 by the population of each country as discussed in a subsequent section.
[10] We thank an anonymous reviewer for suggesting this.

Table 1
Correlation and descriptive statistics.

	1	2	3	4	5	6	7	8	9	10	11
(1)Log (Total recovered)	1										
(2)Total Tests	0.5561***	1.0000									
(3)Centralized	0.1507	−0.0507	1.0000								
(4)Healthcare Investment	0.3945***	0.4330***	0.0767	1.0000							
(5)Total H1N1 affected	0.3589***	0.2919***	−0.0692	0.2031*	1.0000						
(6)GDP per Capita	0.4645***	0.3802***	0.3074***	0.3882***	0.1690	1.0000					
(7)Population	0.2199**	0.2282**	−0.0584	−0.0574	0.0269	−0.0619	1.0000				
(8)Universal government funded healthcare	0.1347	0.0295	0.3992***	0.1365	0.1717	0.3047***	−0.0573	1.0000			
(9) Universal public insurance system	0.1529	0.0396	−0.1017	0.0752	0.0435	0.2645**	−0.0848	−0.2776**	1.0000		
(10) Universal public–private insurance	0.3244***	0.0802	−0.1524	0.0473	−0.0306	0.0360	−0.0099	−0.1661	−0.206*	1.0000	
(11) Non universal insurance system	−0.0251	0.2469**	−0.1524	−0.1139	−0.0478	−0.0639	0.4342***	−0.1661	−0.1166	−0.1233	1.0000
Mean	5.19	142501.10	0.16	6.97	72451.63	18313.01	54300000.00	0.18	0.26	0.11	0.11
Std. Dev.	2.49	387311.40	0.37	2.60	400206.10	21109.27	159000000.00	0.39	0.44	0.31	0.31

*** significant at 1%level|**significant at 5% level|*significant at 10% level.

Table 2
Effect of governance structure, healthcare infrastructure, learning from past and insurance infrastructure.

	Model 1 (DV = Reactive Strategies (log Recovered))			Model 2 (DV = Proactive Strategies (Total Tested))		
	Estimates	Std. Error	VIF	Estimates	Std. Error	VIF
Intercept	1.9959***	0.6342		−333296.9000***	111431.7000	
Types of Governance						
Centralized (=1)	1.0925*	0.6362	1.3600	−87056.3300	111784.1000	1.3600
Healthcare Infrastructure						
Healthcare expenditure as % of GDP	0.2088**	0.0849	1.2200	48814.1700***	14919.8600	1.2200
Learning From Past						
Total affected H1N1	0.0000017***	0.0000005	1.1100	0.1842*	0.0927	1.1100
Insurance infrastructure						
Universal government funded healthcare	0.4860	0.6611	1.6500	−64617.2500	116155.2000	1.6500
Universal public insurance system	1.2207**	0.5685	1.5600	−43035.1200	99882.3900	1.5600
Universal public–private insurance	3.1858***	0.7185	1.2800	68316.7100	126252.9000	1.2800
Non universal insurance system	0.1854	0.7566	1.4100	276912.1000**	132940.7000	1.4100
Control Variables						
GDP per Capita	0.0000**	0.0000	1.7000	5.5109**	2.1735	1.7000
Population	0.0000***	0.0000	1.2400	0.0004	0.0002	1.2400
Total observations	82.0000			82.0000		
R-square	53.6000			40.6600		
Ad. R-Square	47.8000			33.2400		

*** significant at 1% level|**significant at 5% level|*significant at 10% level.

Table 3
Controlling the effect of proactive strategies on reactive strategies.

Model 1 (DV = Reactive Strategies (log Recovered))			
	Estimates	Std. Error	VIF
Intercept	2.7260***	0.6250	
Types of Governance			
Centralized (=1)	1.2832**	0.5938	1.3800
Healthcare Infrastructure			
Healthcare expenditure as % of GDP	0.1019	0.0846	1.4000
Learning From Past			
Total affected H1N1	0.000001**	0.0000	1.1700
Insurance infrastructure			
Universal government funded healthcare	0.6276	0.6157	1.6600
Universal public insurance system	1.3150**	0.5290	1.5600
Universal public–private insurance	3.0361***	0.6692	1.2800
Non universal insurance system	−0.4212	0.7241	1.5000
Control Variables			
GDP per Capita	0.0000	0.0000	1.8500
Population	0.0000**	0.0000	1.2800
Practive Strategy	0.000002***	0.0000	1.6900
Total observations	82.0000		
R-square	60.4800		
Ad. R-Square	54.9100		

*** significant at 1% level|**significant at 5% level|*significant at 10% level.

Table 4
Joint estimation.

	Model 1 (DV = Reactive strategies (log recovered))		Model 2 (DV = Proactive strategies(total tested))	
	Estimates	Std. Error	Estimates	Std. Error
Intercept	1.9959***	0.5943	−333296.9000***	104416.2000
Types of Governance				
Centralized (=1)	1.0925*	0.5961	−87056.3300	104746.5000
Healthcare Infrastructure				
Healthcare expenditure as % of GDP	0.2088***	0.0796	48814.1700***	13980.5400
Learning From Past				
Total affected H1N1	0.0000***	0.0000	0.1842**	0.0869
Insurance infrastructure				
Universal government funded healthcare	0.4860	0.6194	−64617.2500	108842.4000
Universal public insurance system	1.2207**	0.5327	−43035.1200	93594.0500
Universal public–private insurance	3.1858***	0.6733	68316.7100	118304.3000
Non universal insurance system	0.1854	0.7090	276912.1000***	124571.1000
Control Variables				
GDP per Capita	0.0000**	0.0000	5.5109***	2.0367
Population	0.0000***	0.0000	0.0004	0.0002
Total observations	82.0000		82.0000	
R-square	53.6000		40.6600	

*** significant at 1% level|**significant at 5% level|*significant at 10% level.

Table 5
Scaled independent variables.

	Model 1 (DV = Reactive strategies (log recovered))			Model 2 (DV = Proactive strategies (total tested))		
	Estimates	Std. Error	VIF	Estimates	Std. Error	VIF
Intercept	1.9378***	0.6346		−340452.6000***	111582.5000	
Types of Governance						
Centralized (=1)	1.0938*	0.6388	1.3700	−88987.9100	112309.9000	1.3700
Healthcare Infrastructure						
Healthcare expenditure as % of GDP	0.2165**	0.0849	1.2100	49815.9700***	14928.4500	1.2100
Learning From Past						
Total affected H1N1 (SCALED)	103.7984***	32.8495	1.1200	10600000.0000*	5775608.0000	1.1200
Insurance infrastructure						
Universal government funded healthcare	0.4416	0.6660	1.6700	−67238.3300	117099.6000	1.6700
Universal public insurance system	1.2233**	0.5703	1.5600	−42523.5200	100264.3000	1.5600
Universal public–private insurance	3.1950***	0.7210	1.2800	68787.9200	126762.4000	1.2800
Non universal insurance system	0.2003	0.7593	1.4200	277796.3000**	133500.1000	1.4200
Control Variables						
GDP per Capita	0.0000*	0.0000	1.7000	5.5122**	2.1831	1.7000
Population	0.0000***	0.0000	1.2400	0.0004	0.0002	1.2400
Total observations	82			82		
R-square	53.99			40.2		
Ad. R-Square	47.47			32.73		

*** significant at 1% level|**significant at 5% level|*significant at 10% level.

spending as a percentage of GDP in *i*th country. This means that the operationalization of healthcare infrastructure inherently captures the population aspects; scaling it by the population of respective countries may over emphasize the effects of population. However, our measure of learning from past, i.e., number of infections from H1N1, can be scaled by the countries' population. In an additional analysis, we re-estimate Eq. (1) and Eq. (2) with the scaled value of the number of infections from H1N1 by the population of each country. As shown in Table 5, we find consistent results and support for our hypotheses.

5.4. Alternate independent variable

We have two operationalizations for healthcare infrastructure, and we have used healthcare spending as a percentage of GDP in our proposed modeling framework. However, we also estimate Eq. (1) and Eq. (2) with number of physicians per 1000 people as an indicator of healthcare infrastructure. Estimation results provide directionally consistent insights.

6. Discussion

In this study, we investigated the effects of macro managerial factors, namely type of governance, healthcare infrastructure, and learning from past pandemics, on the response to the COVID-19 pandemic in terms of proactive strategies and reactive strategies. Building on learning theory and the extant literature on rare events, we proposed a set of hypotheses and a conceptual framework. We then collected data to test the framework. By doing so, we make multiple contributions to the literature, policy, and humanity.

6.1. Contributions to the literature

In this paper, we identify that responses to COVID-19 are affected by a country's governance structure, healthcare infrastructure, and learning from past pandemics. From the perspective of theory, this study contributes to the literature on pandemic control and prevention. While multiple scholars have focused on understanding how clinical solutions may prevent a pandemic, limited research has looked at the macro-level factors that may drive a country's reaction to a pandemic (Leung et al., 2020). In doing so, we make multiple contributions to the theory.

First, from the perspective of learning theory, this paper examines learning accumulated through experiencing a pandemic and its effect on responses to a new pandemic. Multiple scholars have argued that learning developed through experience may not be effective in pandemics as existing routines may become obsolete (Roux-Dufort, 2007). We, however, show that while existing routines may not be effective during pandemics, investment in healthcare remains effective as it can facilitate quick adaptation, enabling responses to a pandemic. Thus, we broaden the literature on organizational learning. While the effect of the pandemic is always negative in the sense that a country experiences infections and deaths, if the country can learn from the experience, this can help it to overcome the negative effects of COVID-19 or any future pandemic. Hence, we extend the existing literature on COVID-19, which has shown a differential effect of macro-factors on public health responses (Leung et al., 2020).

Second, we highlight the role of governance structure and its effect on proactive and reactive responses to COVID-19. While research in learning has looked at governance structure, limited research has focused on understanding the role of governance in developing a proactive or reactive approach to a pandemic. From the theoretical perspective, our research highlights that governance structure and its effect on pandemic reaction is much more nuanced. Contrary to the conventional wisdom that views governance as an economizing mechanism, we highlight that a centralized governance structure may not facilitate a proactive response to a pandemic. In doing so, we offer a resolution to the debate in the literature that has made paradoxical claims about the role of governance in the management of pandemics (Schwartz 2012; Jiang et al., 2020). We show that while both centralized and decentralized governance structures can impact the management of a pandemic, there is a differential effect on reactive and proactive strategies.

Third, we contribute to the literature on rare events, especially healthcare-related rare events, by showing that three macro managerial factors can affect a country's response to COVID-19 in addition to the clinical and vaccine-related factors that already exist in the extant clinical and medical science research. This is perhaps one of the most important insights as there has been little research exploring the effects of macro-level factors on a country's COVID-19 response. The extant rare event literature largely looks at the economic, political, environmental, and social factors affecting rare events and responses to rare events. Over and beyond this, it is critical to identify additional factors that may influence responses to rare events – this study is an attempt to reveal a few of these.

6.2. Contribution to policy

This study guides countries and makes recommendations for changes in various policies. First, healthcare investment is essential in fighting a pandemic. While it is probably the most intuitive finding, in many countries, such investment is extremely low. In India, healthcare investment is just 3.6% of the GDP, whereas in China it is around 5%.[11] Thus, while it is time for developing nations to focus more on issues associated with healthcare, our insights suggest that by increasing healthcare infrastructure (as a percentage of GDP), the response to COVID-19 can be enhanced.

Second, our paper highlights the role of governance in containing pandemics, especially COVID-19. Whether central or state governments should be leading the fight against the pandemic remains an important question, particularly as different levels of government seem to hold varied opinions on the issue. One such example is Brazil, where governors are opposing the federal government in terms of which strategies to

use in the fight against COVID-19.[12] Our research shows that centralization facilitates a reactive response to COVID-19. Recent scholarship in medicine has also argued that centralized structure played a vital role in achieving success against COVID-19 in countries such as Vietnam (Kuster and Overgaard, 2020).

Third, our paper highlights the need to learn from prior pandemics. This is a critical finding as many governments may not institutionalize learning once the rare event is over. Through our paper, we urge countries to develop an institutional mechanism to retain learning occurring because of rare events.

Finally, we urge policymakers to create an insurance infrastructure that facilitates a proper response to pandemics. Similarly, policymakers should try to continuously evaluate the health of the elderly population, for example, through regular health checkups. In many countries, however, the awareness of such programs remains low (Kasthuri 2018), and we urge policymakers to invest in making the population aware of such services.

In terms of healthcare infrastructure policies, it is recommended that countries have flexible rules and policies designed for responses to pandemics. For example, having strict guidelines for healthcare investment or insurance setups or criteria for medical graduates to join the workforce may not be fruitful in pandemic or other healthcare-related rare events. To combat such a situation, countries could design "pandemic-specific healthcare policies" and activate them only during pandemics. This would help the country in two ways in that it would benefit from these policies in general and during a pandemic. Moreover, having policies of infusing emergency funding into healthcare, relaxing the approval guidelines for potential medicines, and prioritizing policies such that survival is given more importance than the rules would help countries respond properly to the pandemic in general and the COVID-19 pandemic specifically.

Regarding policies related to international relations and collaboration, the insights from the results highlight the need for knowledge/experience sharing through international collaboration (e.g., clinical trials, licensing, research priorities, protocols) (Gates 2020). Learning from previous pandemics and sharing this learning on international platforms (e.g., International Severe Acute Respiratory and Emerging Infection Consortium trial network and the Global Research Collaboration for Infectious Disease Preparedness) would help the global community to develop preparedness strategies, preventive measures, and clinical measures to save lives, slow the global circulation of COVID-19, and prevent future outbreaks (Gates 2020). However, this is only possible with collaboration across countries.

In terms of policies related to the administration of each country, government and industry need to come to an agreement so that policies related to vaccine and antiviral medication development are given priority, and the bid goes to whoever can develop effective and quick solutions affordable to people with the greatest need. During a pandemic, there should be flexible budget allocation. Countries should enact "disease surveillance, including a case database that is instantly accessible to relevant organizations, and rules requiring countries to share information. Governments should have access to lists of trained personnel, from local leaders to global experts, who are prepared to deal with an epidemic immediately, as well as lists of supplies to be stockpiled or redirected in an emergency. However, this is only possible when there will be collaboration across countries" (Gates 2020).

Finally, as not all insurance infrastructure is helpful, policies towards the adoption of hybrid insurance infrastructure and/or the ability to switch the infrastructure will help a country respond to a pandemic.

6.3. Contributions to humanity

The world wants to be a pandemic-free place where everybody can

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[11] https://www.livemint.com/news/india/india-s-economy-needs-big-dose-of-health-spending-11586365603651.html

[12] https://time.com/5816243/brazil-jair-bolsonaro-coronavirus-governors/

work and live safely. However, over history, the world has suffered from a variety of pandemics. Most recently, the effects of COVID-19 have been so devastating that many countries have experienced thousands of deaths, losses in jobs and income, separation from families, and the degradation of business activities, all resulting in a potential economic downturn. In this context, it is valuable to have even small amounts of information to combat the effects of COVID-19. Hence, this study reveals the macro managerial factors that may help a country enhance its recovery and reduce deaths, while also providing strategic recommendations for changes in policies. By adopting some of the suggested recommendations, it would be possible to reduce death, increase recovery, and better prepare for future events, thus helping humanity survive and prosper.

7. Limitations and future research directions

The paper has several limitations. First, due to a lack of data availability across countries, the various models we estimated have different sample sizes. While sample size should not directionally change the model estimates, it can lead to an over or under-estimation of the effect size. This is a note of caution if our results are to be considered for policy development. Second, we have largely relied on various public sources for data; in many cases, we could not obtain current data. For example, healthcare investment as a percentage of GDP data is as per the 2016 schedule. Future research may attempt to gather current data (i.e., data for 2020) to generate more robust insights. Third, most of our variables (i.e., governance structure, learning from past pandemics) are time-independent (i.e., we can get a number for a country), which limits our ability to consider longitudinal data to derive insights. Fourth, while we considered total testing conducted in estimating Eq. (1), it may be necessary to account for the time lag between recovery and testing in a much more nuanced way. One way would be to dynamically model the effects of testing on recovery by taking 14, 21, and 28 days of lag. This approach would provide an in-depth understanding of the impact of testing on recovery. However, it may not be helpful in answering our questions. Fourth, countries conducting testing and experiencing recovery seem non-linear and are affected by various other factors, such as the healthcare supply chain, global value chain, availability of healthcare workforces, lockdown and social distancing measures, and administration-related issues. If the responses are non-linear, our models and approach may not be able to capture those. Moreover, with changes in the numbers of recovery and testing, we may need to account for several other factors, as discussed above, to obtain the same relationships that we identified in this paper. Consideration of such a research avenue is critical for developing nuanced insights for predictive as well as theory development perspectives. Last, as recovery and testing may be affected by several other unknown factors, estimating latent parameter models or creating a model to tease out the effect of people suffering but not tested on recovery would be helpful for the pandemic as well as the epidemiology literature.

Appendix A. Supplementary material

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jbusres.2020.09.011.

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