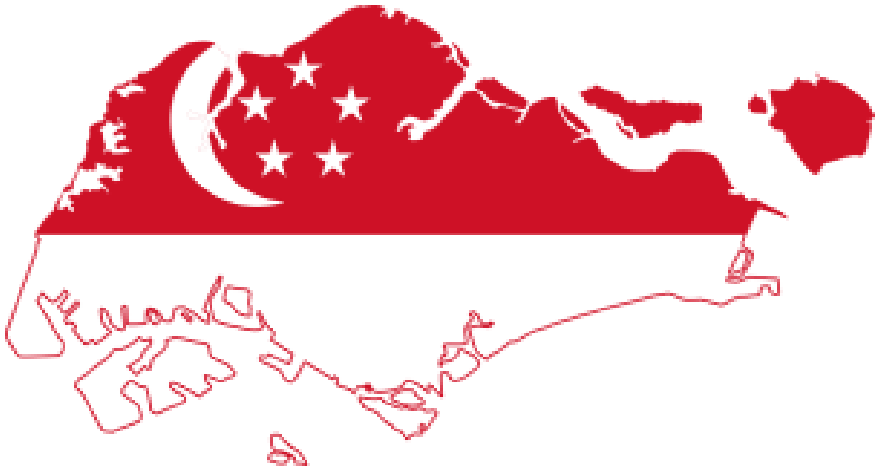
Singapore physical distancing policies and epidemiology from January - September 2020: A case report

Policy Frameworks and Epidemiology of COVID-19 Working Group

June 2021



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Conflicts of Interest

No conflicts of interest were reported.

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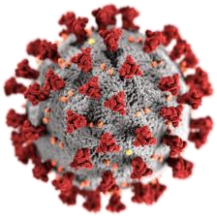
I. Introduction and project description

A new disease that spread around the world

On December 31, 2019, the World Health Organization (WHO) was notified of a cluster of individuals with pneumonia of unknown cause in Wuhan, China.(1) On January 12, 2020, China shared the genetic sequence of the novel coronavirus with other countries to help develop diagnostic tests.(1) Thailand reported the first known case of the novel coronavirus outside of China on January 13, 2020. WHO declared the novel coronavirus (2019-nCoV) outbreak a Public Health Emergency of International Concern on January 30, 2020 with 7,711 confirmed cases, 12,167 suspected cases, and 170 deaths in China and 83 cases in 18 countries outside of China.(1,2) The disease was later named COVID-19 for coronavirus disease 2019 and the virus referred to as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2).(1) WHO declared COVID-19 a pandemic on March 11, 2020.(1)



Physical distancing policies and knowledge gaps

As an emerging infectious disease, there were originally no effective vaccines or preventive treatments widely available for SARS-CoV-2. Therefore, governments have had to rely on the use of public policies to combat the spread of the virus.(1-4) Creating policies has been difficult due to the large amount of information and ongoing uncertainty around the characteristics of the virus and who it affects.(4) One of the most commonly used policies to mitigate (slow) the spread of the virus that causes COVID-19 centres on physical or social distancing, which relies on separating people to reduce the transmission of the virus.(5) However, it is still unclear when is the best time to institute such policies. There are many aspects of distancing, such as recommendations for maintaining a physical distance in public, banning group gatherings, or complete lockdowns, that complicate their assessment.(5) There are also many factors that have been attributed to people acquiring or having a worse outcome from COVID-19.(6-11) However, there is no harmonized database available with all the policies, epidemiology and contextual information that is needed in order to perform comparative analyses useful to informing policymaking.

About this project

The Policy Frameworks and Epidemiology of COVID-19 Working Group was developed after a "CONVERGE Virtual Forum: COVID-19 Working Groups for Public Health and Social Sciences Research." A group of international researchers convened to explore what physical distancing policies countries implemented and their effects on the epidemiology of COVID-19. The Working Group was further supported through an award from CONVERGE and the Social Science Extreme Events Research (SSEER) Network. CONVERGE is a National Science Foundation-funded initiative headquartered at the Natural Hazards Center at the University of Colorado Boulder.

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II. Methods

Research design

A qualitative embedded multiple case study research design was used to compare countries (or subnational jurisdictions, such as provinces, states or territories). The suite of public policies and resulting changes in the epidemiology of COVID-19 are examined within their specific country setting. Our cases start in January 2020 and end in August 2020. (Please see full study proposal). Research ethics approval was obtained by the Hamilton Integrated Research Ethics Board (HIREB) (Project # 11243).

Data collection

For each country, the setting, such as health systems, political systems and demographics were described to help with interpretation of findings and potential transferability, or the degree to which findings are applicable to other sites or future research.

Publicly available data was first collected on the jurisdiction following a standardized data collection form. Epidemiological data was drawn from publicly available data. WHO, World Bank, Central Intelligence Agency and other publicly available sources were used for timelines and country characteristics, where possible. Other sources of information included governmental and non-governmental websites, news articles, government reports, and peer-reviewed journals.

Next, key informant interviews were conducted to fill in gaps, verify information found through the documentary searches, and identify further participants and documentary sources of relevant information. (See informed consent and interview guide) Key informant interviews were conducted with policymakers, health workers, researchers and other stakeholders as appropriate to fill in knowledge gaps.

Data analysis and presentation

Our COVID-19 policies and epidemiology databases harmonize data on setting characteristics, policies, demographic characteristics and epidemiological risk factors and outcome metrics. These will further be described in single country or jurisdiction case reports. Comparisons will be selected based on both literal and theoretical replication. Countries that have similarities in either policies or epidemiological trends can be considered literal comparisons, whereas countries that differ will be used as theoretical comparisons. These comparisons will be submitted to peer-reviewed journals for publication.

III. Findings

A. Setting characteristics

Geographic, environmental, social and economic contextual factors

Singapore is in the WHO Western Pacific Region.(12) Singapore has a population of 5,703,569 people and a population density of 7953 people per km^2.(13,14) Most urbanization is along the southern coast, and there are relatively dense population clusters located in the central areas. Singapore consists of about 60 islands. With land reclamation, many former islands are removed, and newer ones are formed. Singapore is a focal point in the Southeast Asian sea routes.(15)

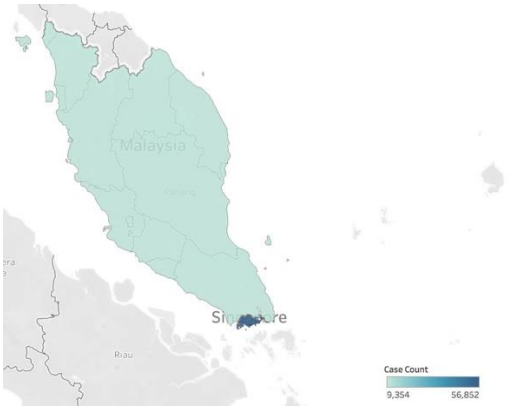


Figure 1. Heat map of COVID-19 cases in Singapore & Malaysia – 1 September 2020 (16)

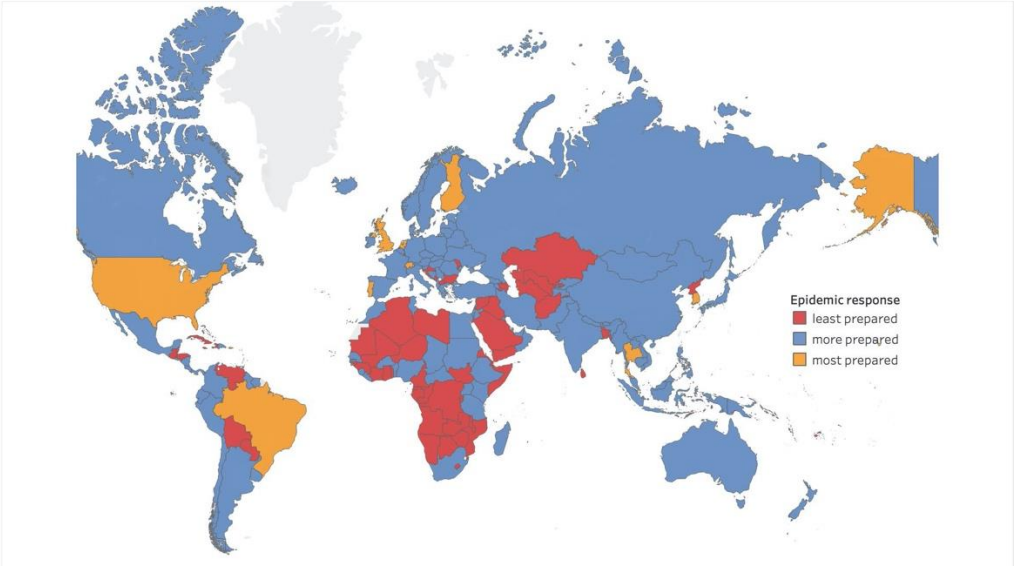


Figure 2. Global Health Security epidemic preparedness rank category (17)

Table 1. COVID-19 relevant contextual factors for Singapore

Global Health Security Index, 2019 (Overall Index Score out of 100 and category) (17)	58.7 - More prepared
Global Health Security Index, 2019 (Epidemic Preparedness Index Score out of 100 and category) (17)	34.1 - More prepared
Particulate matter (PM2.5) air pollution, mean annual exposure, 2017 (micrograms per cubic meter) (18)	19.08
PM2.5 air pollution, population exposed to levels exceeding WHO guideline value, 2017 (% of total) (19)	100
International migrant stock, 2015 (% of population) (20)	45.39
Trust in national government, 2018 (% of population) (21)	73.58
Mobile cellular subscriptions, 2019 (per 100 people) (22)	156.38
Individuals using the internet, 2019 (% of population) (23)	88.95
Index of economic freedom, 2020 (Rank and category) (24)	89.4 - Free
World Bank classification, 2020 (25)	High
Gini Index, 2017 (26)	N/A
GDP per capita, PPP, 2019 (Current international $) (27)	101,375.78
GNI per capita, PPP, 2019 (Current international $) (28)	92,020
Current health expenditure, 2017 (%) (29)	4.4
Vulnerable employment, total, 2020 (% of total employment) (30)	9.66
Vulnerable employment, female, 2020 (% of female employment) (31)	6.57
Vulnerable employment, male, 2020 (% of male employment) (32)	11.87
Homelessness (%) (33)	N/A
Adult literacy rate, 2018 (%) (34)	97.34
Literacy rate, adult female, 2018 (% of females 15 and above) (35)	95.92
Literacy rate, adult male, 2018 (% of males 15 and above) (36)	98.85
Primary school enrolment, 2017 (% net) (37)	99.67

GDP - gross domestic product; **GNI** - gross national income; **N/A** – not available; **PPP** - purchasing power parity

Population health characteristics

Life expectancy at birth in Singapore was 83.15 years in 2018.(38) For males, life expectancy at birth was 81 years, and for females it was 85.4 years.(39,40) Non-communicable diseases are believed to play a role in who develops severe symptoms of COVID-19. In Singapore, the proportional mortality from cardiovascular diseases was 29%, cancers 30%, chronic respiratory diseases 3%, and diabetes 1% (See Figure 3).(41) The probability of dying between ages 30-70 from cardiovascular disease, cancer, diabetes, or chronic respiratory disease was 9.3% for all adults, and 11.8% and 6.9% for males and females, respectively.(42)

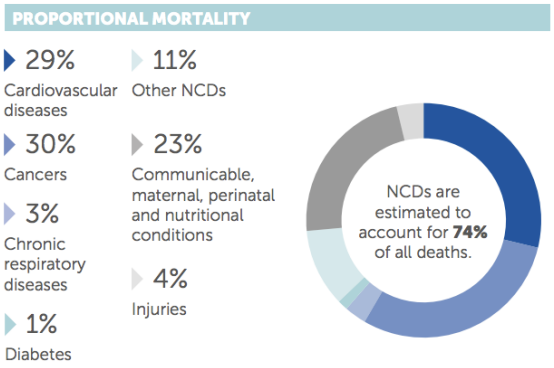


Figure 3. Proportional mortality from non-communicable diseases (NCDs) - Singapore, 2016 (41)

Table 2. Age and health characteristics for Singapore

	Male	Female	Total
Population ages 0-14, total, 2019 (% of total population) (43-46)	361,736 (6.34)	341,603 (5.99)	703,336 (12.33)
Population ages 15-64, total (% of total population) (47-50)	2,287,093 (40.10)	2,006,294 (35.18)	4,293,383 (75.28)
Population ages 65 and above, total (% of total population) (51-54)	336,648 (5.90)	370,194 (6.49)	706,851 (12.39)
Current tobacco use prevalence, total, 2018 (%) (55)	27.8	5.1	16.5
Raised blood pressure (Systolic blood pressure ≥140 or Diastolic Blood Pressure ≥90), ages 18+, 2015 (%) (56)	19.7	13.7	16.7
Raised fasting blood glucose (>7.0mmol/L or on medication), ages 18+, 2014 (%) (57)	10.7	7.7	9.1
Prevalence of obesity among adults (Body Mass Index ≥30), 2016 (%) (58)	6.2	7	6.6
Prevalence of Human Immunodeficiency Virus (HIV), 2019 (% of population ages 15-49) (59)			0.2
Bacillus Calmette-Guérin (BCG) Immunization coverage estimates (%) (60)			98
Prevalence of undernourishment, 2018 (% of population) (61)			N/A

Governance and health systems

Singapore is a democratic country with a parliamentary republic system of governance.(15) The current governing party in power, People's Action Party (PAP), is positioned centre-right on the political spectrum.(15) Singapore has a unitary government with constitutional division of power for the Ministry of Health.(62,63)

The Ministry of Health (MOH) is responsible for regulating the overall health system. Although MOH has centralized certain functions to avoid fragmentations, it distributes responsibilities to five primary organizations: MOH Holding, The Agencies for Care Effectiveness, The Health Sciences Authority, The Health Promotion Board, and The Central Provident Fund Board.(64)

MOH Holding provides subsidies to Integrated Health Information Services and The Agency for Integrated Care.(64) The Integrated Health Information Services manages the information technology across all public healthcare systems. The Agency for Integrated Care helps coordinate individuals with community care. The Agencies for Care Effectiveness is responsible for providing information on cost-effective drugs and treatments.(64) The Health Sciences Authority regulates the manufacture, storage and advertisement of health products. It ensures health products meet safety, efficacy and quality standards. The Health Promotion Board helps promote healthy living in Singapore. It is responsible for creating health policies, implementing health promotion and disease prevention programs. The Central Provident Fund Board organizes and administers the financing schemes in the MOH.(64)

Singapore's healthcare is financed through the following programs: Medishield Life, MediSave, and MediFund.(64) Medishield Life is a universal healthcare insurance for citizens and permanent residents that covers large hospital bills and select outpatient treatments. MediSave is a national medical savings scheme that covers out of pocket payments. Residents contribute to this account through their personal and employer salary. Medifund provides financial aid for Singaporeans who cannot cover their out-of-pocket expenses with their MediSave account.(64)

Table 3. Political and health system indicators for Singapore

Fragile States Index score, 2020 (maximum 120, higher is worse) (65)	26.3
Fragile States Index rank, 2020 (out of 178 countries, higher is better) (65)	162
Global Freedom score and status, 2020 (66)	50 – Partly Free
Internet Freedom score and status, 2020 (67)	54 – Partly Free
World press freedom index, 2020, global score (0-100, lower is better) and rank (out of 180 countries, lower is better) (68)	55.23 - 158
Physician density, 2016 (physician/1,000 pop) (69)	2.29
Hospital bed density, 2015 (beds/1,000 pop) (70)	2.4

Pandemic experience and preparedness

The COVID-19 pandemic preparedness of Singapore is influenced by past experiences, such as the Severe Acute Respiratory Syndrome (SARS) outbreak in 2003 and the Influenza A (H1N1) pandemic in 2009. From the SARS outbreak, there were 238 cases with 33 reported deaths in Singapore.(71) This outbreak highlighted weaknesses in Singapore's surveillance and healthcare system, and several changes have been made since then.(71) In response to SARS, Singapore established The Disease Outbreak Response System, which set the framework for responses to other outbreaks.(71) Singapore has also replaced its 39-isolation bed Communicable Disease Centre with the National Centre for Infectious Diseases (NCID). This consists of a 330-bed facility that has clinical, laboratory, and epidemiological functions.(71) Along with this framework, professional personnel and training of healthcare workers have expanded. Isolation facilities have also increased in public hospitals. From the SARS outbreak, the Singapore government recognized the significant role of government in crisis management.(72) From a ministerial committee in SARS to a multi-ministry task force in COVID-19, Singapore was able to overcome certain COVID-19 challenges.(73)

Another major pandemic Singapore experienced is the H1N1 pandemic in 2009. H1N1 infected at least 415,000 people with 18 reported deaths.(73) Compared to SARS, H1N1 had different epidemiological characteristics and therefore, health control measures had to be customised according to the differences.(72) For example, SARS is most likely transmitted after an individual develops a fever, but H1N1 is contagious even with mild symptoms.(72) These differences in transmission were accounted for when deriving a pandemic response for H1N1. Researchers at the NCID have confirmed that the transmission and severity of COVID-19 is closer to H1N1 compared to SARS.(74) As experience from SARS influenced the H1N1 pandemic responses, lessons from H1N1 pandemic influenced the preparedness of COVID-19. One of these lessons was to rely on local disease surveillance and world reports to detect early signals of an outbreak.(75) Along with increased surveillance, integrated responses from different systems level were essential for coherent public health responses. Strategies also focused on building and maintaining healthcare surge capacity. For example, in H1N1, all suspected cases were required laboratory testing to isolate positive cases.(75) Without surge pandemic planning, there would be overwhelming numbers of suspected cases in isolation facilities, thereby increasing the waiting time for new admissions.(75) Finally, the H1N1 pandemic showed the importance of timely and clear communication to the public to reduce anxiety and engage citizens in measures.(75) Characteristics of these lessons with COVID-19 response will be further addressed in the policies and epidemiology section of this report.

Table 4: Comparison of Characteristics of SARS, H1N1, and COVID-19 in Singapore

	SARS EPIDEMIC	H1N1 PANDEMIC	COVID-19 PANDEMIC
General Outbreak Period	November 2002 to July 2003 (72)	April 2009 to August 2010 WHO pandemic declaration: June 11, 2010 (72)	December 2019 – current date WHO pandemic declaration: March 11, 2020 (76)
First Reported Case in Singapore	1 March 2003 (72)	27 May 2009 (72)	23 January 2020 (78)
Outbreak Origin	Hong Kong, China (72)	Mexico (72)	Wuhan, China (76)
Transmitting Pathway	Human respiratory droplets. Generally contagious when an individual has a fever (72)	Human respiratory droplets. Contagious before even experiencing fever. (72)	Human respiratory droplets. Contagious even before experiencing fever (77)
Total Cases in Singapore	238 (72)	At least 415, 000 (73)	56, 812 (As of August 31, 2020) (78)
Total Deaths in Singapore	33 cases (72)	18 cases (72)	27 (As of August 31, 2020) (78)

SARS – Severe Acute Respiratory Syndrome**; H1N1 –** Influenza A

Laboratory Systems

Singapore has a mix of laboratory systems, including public health, hospital, academic centres, and private laboratories, all of which play a critical role in the COVID-19 testing process.(79) In response to the SARS outbreak, Singapore ramped up its testing capabilities. In May 2020, the daily average of 2,900 tests increased to more than 8,000. Samples are being sent from hospitals to public and private labs. Singapore wants to further expand its testing capacity to 40,000 a day.(79) The testing uses reverse transcription - polymerase chain reaction and has shown to have a high accuracy in the detection of COVID-19. Notably, Singapore was also the first country to use an experimental antibody test for COVID-19 to confirm a case on February 27, 2020. With the mass testing, Singapore was challenged by test kit shortages and turned to local industries for kit development.(79)

B. Policies and epidemiology

Cases and physical distancing policies

Singapore's first case of COVID-19 was recorded on January 23, 2020, and Singapore had 100 cases on February 29, 2020.(78) As of August 31, 2020, there were 56, 812 cases and 27 deaths in Singapore.(78) Figure 4 shows the number of daily cases and deaths in Singapore and dates for select physical distancing policies from January to September 1, 2020.

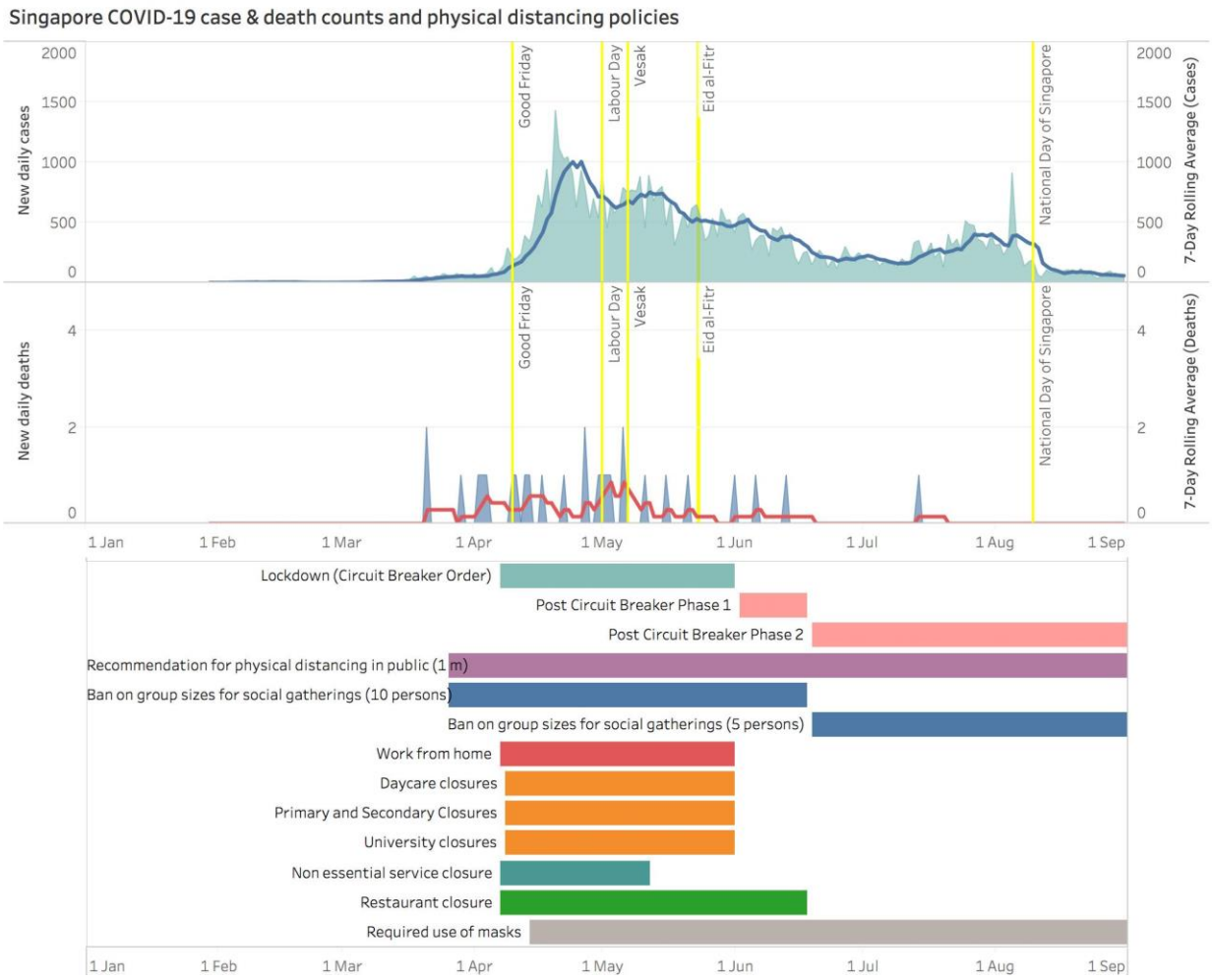


Figure 4. Number of reported COVID-19 cases and deaths in Singapore with select policies from January to September 1, 2020

Description of events in Singapore

The main spokespeople for Singapore's COVID-19 response are the Minister of Health, Gan Kim Yong, and the Minister of National Development, Lawrence Wong.(80) These members are co-chairs of the Multi-Ministry Task Force, which was established to work with international communities and formulate responses in Singapore to reduce the spread of COVID-19.(80) Prime Minister Lee Hsien Loong, and several other ministries work alongside as members in the Multi-Ministry Task Force and can make decisions throughout this process.

Singapore did not declare a specific strategy of containment or mitigation, but it has seemingly followed a mitigation strategy, in which the government aims to minimize transmissions from infected individuals and prevent the spread of COVID-19.(80) To suppress the COVID-19 curve, Singapore has adopted a multi-pronged surveillance strategy. This strategy includes actively tracing contacts, developing case and contact definitions, increasing surveillance among the vulnerable population, and allowing clinician discretion to identify COVID-19 patients.

The extensive contact tracing approach in Singapore has had a significant role in reducing the spread of COVID-19.(81-83) When a patient is diagnosed with COVID-19, the hospital interviews the patient and maps out their movement from before the onset of symptoms to isolation.(82) The activity map includes questions such as places visited, recent activity, and possible close contacts. These maps are then sent to the MOH who oversees the contact tracing operation. The MOH makes calls to third parties to verify the patient's activity map, and then identifies and calls close contacts. If a close contact cannot be reached, the Singapore Police Force would take over and continue to trace the contacts. The Police Force for COVID-19 tracing consists of three divisions: analysis, interview and field team. The analysis team gathers data on COVID-19 cases and identifies any connections between cases. The interview team holds interviews with patients and contacts. The field team tracks down unidentified close contacts by searching through streets, looking through closed-circuit television footages, and conducting door-to-door inquiries.(82) Singapore has also launched applications such as SafeEntry and TraceTogether to further assist with contact tracing. SafeEntry is a digital check-in system which records individuals' entry into places, and TraceTogether is a smartphone application that can identify close contacts using wireless bluetooth technology.(82,83)

Before Singapore's first COVID-19 case, local definition for suspected cases was defined on January 2, 2020 based on clinical and epidemiological criteria.(81) This definition was constantly updated to evolve with the global situation. On March 24, 2020, the government opened its first Community Isolation Facility where patients who are clinically fit for discharge but are still COVID-19 positive can be isolated and treated separately.(84) Along with case definitions and isolation methods, contacts are also defined and categorized in three groups: close, close and asymptomatic, and low risk contacts.(81) Most of these contacts are expected to quarantine at home or serve in government quarantine facilities. Although these contacts vary with characteristics, they are actively assessed by public health officials and transferred to a hospital if they become symptomatic.(81) By the end of January, surveillance measures were enhanced to include testing for the following vulnerable populations: all patients with pneumonia, ICU

patients with possible infectious diseases, and primary care patients with influenza-like diseases.(81)

Table 5: Contact Identification and Assessment Plan for COVID-19 in Singapore – March 2020

Contact Identification	Assessment Plan
Contacts with fever (temperature ≥38°C) or respiratory symptoms (81)	Transferred to a hospital for evaluation and testing (81)
Close Contacts: having close (2 meters) and prolonged (≥ 30minutes) interaction with a COVID-19 patient (81)	Placed under mandatory 14-day quarantine (81)
Asymptomatic Close Contact (81)	Placed under mandatory 14-day quarantine (81)
Low Risk Contacts: had interactions with a case for short period of time (81)	Placed under active monitoring (81)

Similar to compulsory quarantine for close contacts, on March 21, 2020, all incoming residents and long-term pass holders are required to serve a 14 day Stay-Home Notice (SHN) at their own accommodation.(84) They are also required to complete a COVID-19 test before the end of their SHN. On July 19, 2020, Singapore has implemented a new SHN to those with recent travel history to Hong Kong, Victoria, Australia or Japan.(85) These individuals are required to serve SHN at SHN Dedicated Facilities (SDF) instead of their own residence. Non-Singapore citizens or permanent residents are required to pay for their SDF stay.(85)

Another measure implemented by the Prime Minister is a stay-at-home order called the 2020 Singapore Circuit Breaker implemented on April 7, 2020.(86) The Multi-Ministry Task Force announced that Singapore will exit the Circuit Breaker on June 1 and will resume civilian life in three phases.(86) Phase 1, called Safe Reopening, began on June 2, 2020 and is the reopening of economic activities that do not pose high risk of transmission. Phase 2, called Safe Transition, began on June 19, 2020 and consists of reopening more activities. Phase 3, called Safe Nation, is not implemented yet but will be the final stage in which Singapore will reach a new normal.(86)

Singapore had its first case of COVID-19 on January 23, 2020.(87) A Chinese national from Wuhan arrived in Singapore on January 20, 2020. He was admitted at the Singapore General Hospital and was tested positive.(87) On March 26, 2020, Singapore enforced a physical distancing of at least one meter from others in public.(88) Individuals that do not adhere to this measure could be fined up to 10,000 Singapore dollars or jailed up to six months.(89) Robotic dogs were also deployed in Bishan-Ang Mo Kio Park to remind individuals to keep their distance.(90) At first, the Prime Minister discouraged individuals from wearing masks in public.(91) However, on April 14, 2020, masks were made compulsory in the public after receiving evidence showing infected individuals can spread COVID-19 while being asymptomatic.(91) In an effort to encourage this new behavior, reusable masks were distributed to all households. The lack of personal protective equipment (PPE) was not a concern in Singapore.(92) Singapore did not receive PPE from WHO, and overall had a sufficient stockpile of supplies. Through a rotation system developed in 2011, Singapore has adequate

PPE to maintain a 3-6 month minimum stock for hospitals and clinics. Before the COVID-19 pandemic, they also made contracts with third-party providers for PPE management, storage and delivery.(92)

Restriction on group sizes is outlined through the post Circuit Breaker initiative in three phases.(86) In phase 1, households could receive two visitors per day, who must be children and/or grandchildren of the same household. Marriage solemnization and funerals could continue with a maximum of 10 persons. In Phase 2, household visits were extended to five visitors at any time.(86) Marriage solemnization were still restricted to 10 persons, but funerals were extended to up to 20 persons.(93) Wedding receptions were allowed with up to 50 attendees, but all other related activities such as ceremonies and rites had to adhere with the five visitors to a household policy. Singapore did not move to Phase 3, but important changes were brought on August 4, 2020.(94) Marriage solemnization was expanded to 50 people, while funerals were expanded to 20 people.

Along with restrictions on groups sizes, most non-essential businesses were closed on April 7, 2020, and slowly reopened with the three phases. The earliest reopening started on May 12, 2020, which allowed select food places, barber shops and laundry shops to reopen.(95) The MOH mandated that all businesses needed to use a contact tracing system called SafeEntry.(96) Starting June 2, 2020, businesses in settings with low transmission risks were allowed to reopen.(97) Dining in at food and beverage outlets were only allowed to reopen starting June 19, 2020 with only five people to a table and one meter space between tables.(98) At this stage, live music performances and shows were banned.

With the start of the Circuit Breaker, all schools were closed on April 8, 2020. There were limited daycare services for children of parents who had to continue working.(99) Starting June 2, 2020, graduating students of primary and secondary schools were expected to attend school daily, while all other cohorts rotated on a weekly basis between home-based learning and in school lessons.(100) In contrast, there were stricter restrictions for students in University. Starting June 2, 2020, lectures and tutorials remained online, but students returned only for lab sessions.(101) On June 29, 2020, students progressively were allowed back on campus for classes with no more than 50 persons.(102) All large-scale classes remained online. Traditionally, the school year starts in January in Singapore and ends in November, with a week off in March and September and 4 weeks off in June.

The government has released four unity budget projects to support families and livelihoods during COVID-19.(103) On February 18, 2020, the government announced a $1.6B Care and Support Package to support Singaporean families.(103) This included up to $300 for adult Singaporeans and $100 more for each parent with a child below 21 years old. Along with monetary benefits, the government also allocated $100 supermarket vouchers for lower-income families.(103) A $4B Stabilisation and Support Package was also allocated to provide for affected workers and firms.(103) This budget helped retain jobs with wage support. Along with wage support, it provided property tax rebates for the tourism sector and defrayed the costs for the aviation sector. Furthermore, the government announced they will allocate $800M to

support front-line agencies and a $6B assurance package to delay the impact of a Goods and Services Tax (GST) hike for at least five years.(103)

Several suggestions for future waves of the COVID-19 pandemic or future pandemics were provided by an interviewee. Although Singapore was successful with dealing with the cases in the community, the government should have enforced early regulations on imported cases.(104) The interviewee mentions that Singapore was too slow to close the borders. Singapore closed the borders near the end of March 2020 to short term visitors and foreign labourers who do not provide essential services.(105) Prior to the closure of the borders, most COVID-19 cases were imported from Singapore residents and Long Term Pass holders retuning home abroad. Another suggestion for future pandemics provided by the interviewee is to have more focus on foreign worker dormitories, which is further discussed in the disproportionately affected populations.(104) The interviewee also states international cooperation is important in combatting pandemics. Currently Singapore is part of The Association of Southeast Asian nations (ASEAN) that consists of nine other countries. Further involvement with other countries in the region can possibly assist in Singapore's response to pandemics such as COVID-19.(104)

Disproportionately affected populations

There are certain groups that have been affected disproportionately in Singapore.

Foreign Workers

Since April 2020, foreign workers have made up a disproportionate number of COVID-19 cases. Before April, public opinion was relatively positive towards the Singaporean government's response to COVID-19, save for some confusion over best practices regarding masks. However, when foreign worker dormitories had large clusters of outbreaks, authorities and employers were scrutinized for their lack of response leading up to and during the outbreaks.(106) The dormitories have long had poor living conditions, with overpopulated and unsanitary spaces. A May 14, 2020 survey revealed that "the majority (87%) of Singaporeans agree that the workers' living conditions need to be more strictly regulated – with three in five (60%) strongly agreeing and over a quarter (27%) slightly agreeing."(106)

On April 20, 2020, there were 1,436 new reported cases in the country—the most cases reported in Singapore in one day. Of those cases, only 16 were not migrant workers.(107) Despite the high case count, it has been hypothesized that the fatality rate has been relatively low because these outbreaks occurred in a younger population, where the symptoms were milder.(108) On April 21, 2020, all foreign workers living in these dorms were ordered to stay in even if they worked for companies that had obtained permission to continue work during the ongoing Circuit Breaker. By this point, around 10,000 workers with essential jobs had already been moved to other, temporary accommodations like military camps.(109)

For phase two of ending the Circuit Breaker, workers were still ordered to "remain in their dormitories on their rest days" even if they had already been cleared for the virus. (110) The workers' mental health in reaction to these conditions and restrictions has also become a point of concern.(111)

Malaysian-based workers were also particularly affected at the beginning of the pandemic. When the Malaysian government announced on March 16, 2020 that beginning on March 18, 2020, a Movement Control Order would be implemented to prevent Malaysians from exiting the country, there was a mass exodus of workers traveling from Malaysia to Singapore so that they could continue working in Singapore as one tenth of the city-state's workforce.(108) Because they were usually based in Malaysia, many had to now seek accommodations for living in Singapore.(112) The government intervened with financial support and temporary housing, while many Singaporean residents also offered spare rooms to those who were now stranded in the country and who could not secure other housing.(114,115)

Home-Based Businesses

Home-based business owners were especially opposed to suspending operations for the Circuit Breaker. The suspension prevented food businesses from operating during Ramadan, when there was usually an increase in demand.(116) On May 12, 2020, home-based bakeries were

allowed to reopen as one of the few businesses granted this privilege while the Circuit Breaker was still technically underway.(117) Many of the federal government's financial relief policies also supported smaller businesses that were being disproportionately affected by the pandemic; for example, the May 26, 2020 Fortitude Budget offered up to S$10,000 to help Food & Beverage and retail companies switch over to online operations.(118)

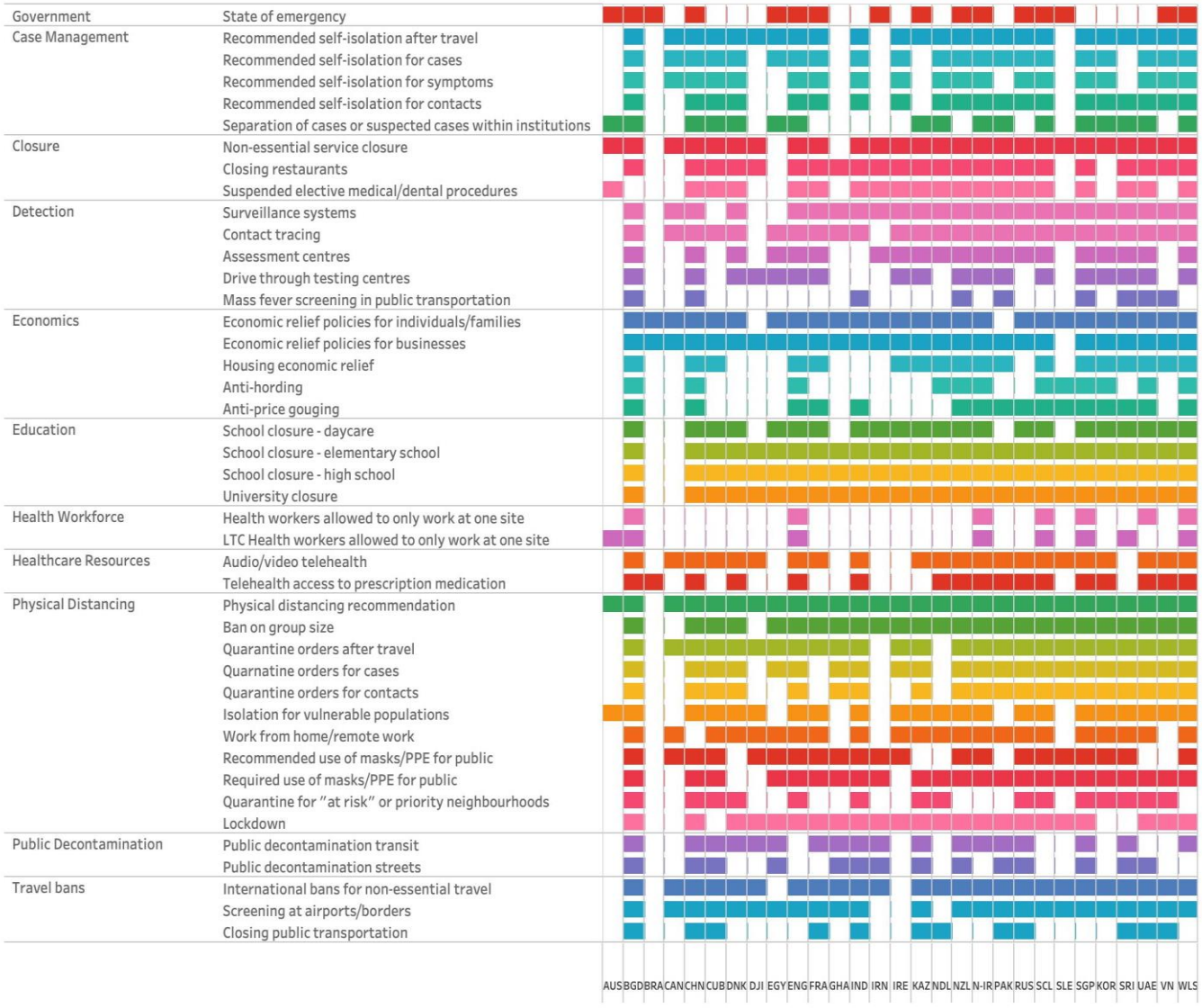
Tourism and Transportation Industries

These industries were especially affected by the pandemic.(118, 119) The Unity Budget that the federal government offered for economic relief on February 18 specifically allocated S$4 billion to businesses and workers from these sectors and other sectors most impeded by COVID-19.(121) These industries continued to be a focus for government support even as the Circuit Breaker ended.(122)

Comparisons with other country responses

There are many concerns in trying to compare countries' responses to COVID-19. This is shaped by limitations of the data itself and differences in contextual factors. A separate paper by this working group describes limitations of COVID-19 data. (Submitted) Table 6 presents a list of countries and their use of different physical distancing policies.

Table 6. Comparative national-level responses to COVID-19 by country – updated August 21, 2020 (filled in means policy was implemented)



AUS–Australia, **BGD**–Bangladesh, **BRA**–Brazil, **CAN**–Canada, **CUB**-Cuba, **DNK**–Denmark, **DJI**–Djibouti, **EGY**-Egypt, **ENG**-England, **FRA**-France, **GHA**-Ghana, **IND**-India, **IRE**-Ireland, **KAZ**-Kazakhstan, **NDL**-Netherlands, **NZL**-New Zealand **NIR**-Northern Ireland, **PAK**-Pakistan, **RUS**-Russia, **SCL**-Scotland, **SLE**-Sierra Leone, **SGP**-Singapore, **KOR**-South Korea, **SRI**-Sri Lanka, **UAE**-United Arab Emirates, **VN**-Vietnam, **WLS**-Wales

IV. Discussion of main findings, limitations, and next steps

Singapore has a population of 5,703,569, with 56, 812 cases and 27 deaths as of August 31, 2020.(13,78) In general, the actual number of cases is likely to be much higher than the confirmed number due to limited testing and a focus on symptomatic community members—a limitation that is true for practically every jurisdiction. That said, Singapore has boasted a strong surveillance and detection capacity compared to other countries, especially near the early stages of the pandemic.(81) Learning from past experiences with the SARS outbreak in 2003, Singapore started early preparations in January 2020 to contain COVID-19. Working with the MOH and NCID, Singapore developed guidelines to identify cases and contacts. After its first case on January 23, 2020, Singapore implemented rigorous contact tracing methods, which include activity mapping, surveillance footages, and door to door inquiries.(82) Coupled with active testing, these early measures have been successful in curbing the spread of COVID-19.

At the community level, Singapore enforced a stay-at-home order, formally called the Singapore 2020 Circuit Breaker, on April 7, 2020.(86) Lockdown measures were lifted on June 2, 2020, in which the state enforced a three-phase plan to return to normal civilian life. Currently, Singapore remains in phase 2, which began on June 19, 2020. With these phases, restrictions on social gatherings started to ease, and non-essential services slowly re-opened. Students returned to school in person or a blended environment with home-based learning starting June 2, 2020. These early reopening did not result in a surge of cases that required the state to enforce another lockdown.(86)

Although Singapore actively monitored to reduce the spread of COVID-19, significant spikes in cases were reported in early April after identifying several foreign workers clustered in dormitories.(106) The pandemic exposed and exacerbated the great inequities that migrant workers experience as compared to the rest of the population. Thousands of workers lived in close proximity and shared facilities, increasing the risk of disease transmission. In response, the government formed special task forces that locked down dormitories with infection clusters, isolated symptomatic individuals, and made accommodations for new workers. Many migrants in the dormitories are still under strict movement restrictions even in Phase 2 of the nation's tiered transition away from Circuit Breaker regulations.(110) The Singaporean government has also been criticized for not closing its international borders soon enough.(104)

Singapore is not at phase 3 of ending Circuit Breaker. In preparation for the potential rise in community cases as a result of a resumption to gatherings and events—albeit with limited crowd sizes—the government has begun taking precautionary steps like making testing more accessible, setting up a committee to examine the country's vaccine approach, and promoting the SafeEntry and TraceTogether programs.(82,83)

Conclusion

Singapore's experiences with the previous outbreaks has prepared it for future emergencies, one of which is the COVID-19 pandemic. With early measures and adherence policies, Singapore has been successful in containing COVID-19 cases and deaths. While Singapore has been lauded for its prompt and precise response to COVID-19, the disproportionate impact that the pandemic has had on migrant workers and other marginalized communities shed a sobering light on the country's existing inequities. That said, the city-state continues to boast the lowest fatality rate for COVID-19 in the world (120), alongside robust tracking, testing, and isolation measures that its largely collectivist society readily adopted. The "Circuit Breaker" lockdown model was also relatively successful in preventing community transmission, an achievement that may serve as a reference to other jurisdictions. After all, one of this paper's key informants has noted the need for more cooperation between countries, especially between ASEAN countries; the insights gleaned from Singapore's response can not only help inform future planning within the country, but they may also be of use to jurisdictions that are still dealing with a high number of community transmissions.(121)

Though the number of community transmissions is currently stable in Singapore, the social and economic impacts of the pandemic are still unfolding as of the writing of this paper. Comparative work is being conducted by this Working Group to understand what policies work, where and why in the international community.

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