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<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>ARI</td>
<td>acute respiratory infection</td>
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<tr>
<td>ART</td>
<td>antigen rapid test</td>
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<tr>
<td>CCF</td>
<td>community care facility</td>
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<tr>
<td>CRF</td>
<td>community recovery facility</td>
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<tr>
<td>CTMA</td>
<td>COVID-19 (Temporary Measures) Act 2020</td>
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<tr>
<td>DORSCON</td>
<td>Disease Outbreak Response System Condition</td>
</tr>
<tr>
<td>ED</td>
<td>emergency department</td>
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<td>EDB</td>
<td>Economic Development Board</td>
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<td>FAST</td>
<td>forward assurance support team</td>
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<td>FET</td>
<td>fast and easy test</td>
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<td>FSS</td>
<td>Flu Subsidy Scheme</td>
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<tr>
<td>GP</td>
<td>general practitioner</td>
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<tr>
<td>GST</td>
<td>goods and services tax</td>
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<tr>
<td>HCW</td>
<td>health-care worker</td>
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<td>HSA</td>
<td>Health Sciences Authority</td>
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<tr>
<td>ICU</td>
<td>intensive care unit</td>
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<td>ID Act</td>
<td>Infectious Diseases Act</td>
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<td>MHCP</td>
<td>MoH Healthcare Claims Portal</td>
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<tr>
<td>MoH</td>
<td>Ministry of Health</td>
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<td>MoM</td>
<td>Ministry of Manpower</td>
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<tr>
<td>MSF</td>
<td>Ministry of Social and Family Development</td>
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<td>MTI</td>
<td>Ministry of Trade and Industry</td>
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<td>NCID</td>
<td>National Centre for Infectious Diseases</td>
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<td>NEA</td>
<td>National Environment Agency</td>
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<td>PBD</td>
<td>purpose-built dormitory</td>
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<td>PCR</td>
<td>polymerase chain reaction</td>
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<td>PET</td>
<td>pre-event testing</td>
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<td>PHPC</td>
<td>public health preparedness clinic</td>
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<td>PPE</td>
<td>personal protective equipment</td>
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<td>PSAR</td>
<td>Pandemic Special Access Route</td>
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<td>QO</td>
<td>quarantine order</td>
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<tr>
<td>RGL</td>
<td>Reciprocal Green Lane</td>
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<tr>
<td>RRT</td>
<td>rostered routine testing</td>
</tr>
<tr>
<td>SAF</td>
<td>Singapore Armed Forces</td>
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<tr>
<td>SAR</td>
<td>special access route</td>
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<td>SARS</td>
<td>severe acute respiratory syndrome</td>
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<td>SASH</td>
<td>Swab and Send Home (programme)</td>
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<tr>
<td>SHN</td>
<td>stay home notice</td>
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<tr>
<td>SIF</td>
<td>swab isolation facility</td>
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<tr>
<td>TCM</td>
<td>Traditional Chinese Medicine</td>
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<td>TOC</td>
<td>Testing Operations Centre</td>
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<tr>
<td>RT-PCR</td>
<td>reverse transcriptase polymerase chain reaction</td>
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</table>
Overview
The Health System Response Monitor (HSRM) is designed to collect and organize up-to-date information on how countries are responding to the coronavirus disease-19 (COVID-19) outbreak. This will be updated periodically (as and when there is a change in COVID-19-related measures) by the respective country contributors. The HSRM focuses primarily on the responses of health systems but also captures wider public health initiatives. The HSRM presents information under six headings:

1. **Preventing local transmission.** This section includes information on key public health measures that aim to prevent the further spread of the disease. It details how countries are advising the general public and people who (might) have the disease to prevent further spread, as well as measures in place to test and identify cases, trace contacts and monitor the scale of the outbreak.

2. **Ensuring sufficient physical infrastructure and workforce capacity.** This section considers the physical infrastructure available in a country and where there are shortages. It describes any measures being implemented or planned to address them. It also considers the health workforce, including what countries are doing to maintain or enhance capacity, the responsibilities and skill-mix of the workforce, and any initiatives to train or otherwise support health workers.

3. **Providing health services effectively.** This section describes approaches to service delivery planning and patient pathways for suspected COVID-19 cases. It also considers efforts by countries to maintain other essential services during periods of excessive demand for health services.

4. **Paying for services.** Health financing describes how much is spent on health and the distribution of health spending across different service areas. The section also describes who is covered for COVID-19 testing and treatment, whether there are any notable gaps (in population coverage and service coverage), and how much people pay (if at all) for those services out of pocket.

5. **Governance.** This discusses governance of the health system regarding COVID-19-related pandemic response plans and the steering of the health system to ensure its continued functioning. It includes emergency response mechanisms, how information is being communicated, and the regulation of health service provision to patients affected by the virus.

6. **Measures in other sectors.** This section contains information on measures undertaken in non-health sectors (such as border and travel restrictions, economic and fiscal measures) to tackle the pandemic.
Introduction

Singapore is an island country with a population of 5.6 million. It used to receive a large number of tourists from mainland China, with more than 400 flights between Singapore and mainland China per week. In 2019, a total of 3.6 million tourists from mainland China visited Singapore [1].

Singapore was one of the first countries to report imported cases of COVID-19 and had the highest number of cases outside mainland China for a time in early February 2020, ranging from 5 to 10 new cases per day and cumulatively crossing 70 cases by mid-February. The rise in cases plateaued towards the end of February but shortly after, daily reported new cases rose to double-digit figures and cumulative cases reached 1000 on 1 April 2020. From 7 April 2020, in view of widespread community transmission, Singapore implemented a suite of significantly stricter islandwide measures, termed the Circuit Breaker (see 7 and 21 April in Table 1 for details of the measures). As the country shifted into Circuit Breaker, large clusters emerged in foreign worker dormitories [2]. Daily new cases averaged hundreds per day in the subsequent months, driven mainly by cases in the dormitories, and cumulative cases crossed 50,000 in August 2020. New cases subsequently dropped and, since October 2020, new local community cases and cases in dormitories have ranged between 0 and 3 per day. New daily imported cases have been in the double digit range but are managed with test/quarantine/isolation protocols [3]. See Fig. 1.

Fig. 1: Epidemic curve of COVID-19 outbreak by press release date

1 Preventing transmission

1.1 Health communication

Health communication plays an important role in Singapore’s COVID response. Since the start of the pandemic, frequent press briefings and public announcements were made by ministers and the Prime Minister on pandemic developments, policies and new measures. They also emphasized the behavioural changes the population should adopt to inhibit spread in the community. The press briefings and announcements are televised nationwide and live streamed on social media channels in the four official languages of English, Mandarin, Malay and Tamil. Their contents are also reported on traditional media platforms (print and online/digital news reporting) and available as documents on various government/government agency websites.

Updates on the epidemiological situation, policies and new measures are communicated daily in the four languages through official websites, traditional and social media channels, and mobile applications. A list of the official information sources/platforms for COVID-19 and specific COVID-19-related topics (e.g. air travel-related information, contact tracing, crowd density at public places, mental health support, employment opportunities, etc.) are available at https://www.gov.sg/article/covid-19-resources. A central source of information on WhatsApp messaging was also set up through which notifications and updates on new COVID-19-related information can be received directly and promptly (see Fig. 2) [2]. Accompanying illustrative posters and explanations in the media by experts and experienced personnel are a common feature in Singapore’s health communication.

Fig. 2: Example of messages sent through the WhatsApp gov.sg subscription service
Community hygiene

Community hygiene practices and socially responsible behaviour featured regularly in the press briefings and information updates, especially in the earlier months of January to March 2020. These accompanied a national campaign (from January 2020) advocating such behaviour and practices, where personal/hand hygiene instructions and socially responsible behaviour were also communicated through posters and even comics islandwide via newspapers or at strategic locations (e.g. lift lobby areas, common commuting points). Local celebrities further advocated for them on social and traditional media platforms [2].

A participatory approach addressing community feedback was sometimes adopted to reassure the public and promote voluntary compliance. For example, from January to March, because the evidence for the use of face masks by the general public was uncertain, the limited supplies were prioritized for health-care workers (HCWs), and there was as yet no widespread community transmission, the national guidance was to don masks only when one was feeling unwell. This prompted public concern and several rounds of explanation were conducted by ministers at press briefings on the rationale for the guidance. However, there remained widespread concern about the shortage of face masks and, in response, a set of four surgical masks was distributed to each of the 1.37 million Singapore households from 1 February.

With the arrival of the Circuit Breaker in April, in view of the widespread community transmission and more definitive evidence of asymptomatic transmission, a change was made to the national guidance on mask-wearing outside of home, which became a requirement by law from 14 April. The guidance was announced at a press briefing and issued in a press release as part of a suite of more stringent Circuit Breaker measures [4, 5]. Official guidance on the use of masks and face shields was issued on 1 June [6], and the government and Temasek Foundation¹ have been distributing reusable and surgical masks to every Singapore resident since April on a bi-monthly basis on average. The masks were offered in four different sizes and could be collected at public locations such as community centres, bus interchanges and migrant workers’ centre recreation club and, from May 2020 onwards, self-collected from 1200 vending machines (see Fig. 3 and 4) [7-10].

Fig. 3: A Singapore resident collecting his free reusable mask


¹ A Singapore-based non-profit organization under the philanthropic arm of the Singapore State sovereign fund.
Physical distancing

Official orders on physical distancing were issued from 27 January 2020. These started out as mandatory “stay-at-home notices” for individuals at varying levels of severity depending on the risk profile of a suspected infected case, and then extended to include broader distancing measures at the community level from February 2020. (See Table 1 for the detailed measures, their corresponding timelines and legal enforcement.) The measures were communicated in the four languages via the official channels and sometimes also announced in press briefings, depending on their level of significance. Most of them were also promulgated as regulations under the Infectious Diseases Act (ID Act) [2, 11-13].

Outbreak situation and response

Information on the severity of the outbreak and responses to it were communicated through daily updates via official channels. The information communicated included the number of imported, community and worker dormitory cases, the clusters and locations that the community cases are linked to, the number of unlinked cases, the number of discharged cases and cases in the intensive care unit (ICU), and deaths. Such information was accompanied by measures taken to address the outbreak, such as how imported cases were placed under stay-home notice (SHN), how contact tracing was being undertaken for community cases, and how public health measures were instituted in affected cluster locations [14].

At important junctures, ministers and, at times, the Prime Minister, provided updates on the epidemiological situation. For example, the Prime Minister addressed the nation the day after Singapore’s outbreak risk assessment was raised to the Disease Outbreak Response System
Condition (DORSCON) orange (on 7 February 2020) to assure the public and prevent continued panic buying of groceries in the supermarkets (see Fig. 10 for DORSCON levels) [2, 15]. He also announced the Circuit Breaker and its extension in April when local transmission cases continued to rise [16] [17], provided an update on the emerging outbreak situation in foreign worker dormitories [18], and addressed the nation on the outlook for the next year as Singapore entered Phase 3 of its COVID-19 reopening. These were interspersed with and complemented by more detailed briefings by ministers in the Multi-Ministry Taskforce² (see also page 46) on changes to existing measures, new measures instituted, and improvements in or worsening of the epidemiological situation [19]. These included details such as the activities/businesses that could resume with Phases 2 and 3 of reopening, setting up of an inter-agency task force, efforts implemented to tackle the situation in the dormitories, and the upcoming vaccination plan for Singapore with the arrival of vaccines [20, 21].

The near- and longer-term outlook for the nation and reminders of continued vigilance featured regularly in these press briefings by the Prime Minister and ministers.

Misinformation

With misinformation typically common in epidemics and leading to substantial public anxiety [22], the government made special efforts to counter fake news. Clarifications on inaccurate news were frequently posted on the government’s website and conveyed through traditional media. Correction directions under Singapore’s Protection from Online Falsehoods and Manipulation Act (POFMA) required parties communicating falsehoods to put up clarification notices or be subject to fines and imprisonment. Several POFMA correction directions were issued to online sites for dissemination of inaccurate COVID-19-related information during the period (see Fig. 5) [2, 23, 24].

Fig. 5: A reported case of POFMA correction

Health Minister asks Pofma office to issue correction direction to States Times Review over Covid-19 post


² On 22 January 2020, the government set up a multi-ministry task force to oversee the national response to COVID-19. It comprised ministers across multiple ministries, including health, trade, communications, manpower and transport.
There is also a dedicated hotline for the public to call for information on the COVID-19 situation. The hotline number is displayed prominently on a fixed banner on the Ministry of Health’s (MoH) website, with a cautionary statement to the public to be aware of scam calls and emails from people impersonating MoH officers and to verify their authenticity by calling the hotline [14, 25]. Singapore has also introduced Factually, a website that clarifies common or viral falsehoods (see Fig. 6).

*Fig. 6: Factually website, which clarifies common or viral falsehoods*

![Factually website, which clarifies common or viral falsehoods](https://www.gov.sg/factually)

*Source: https://www.gov.sg/factually*

**Communications around long-term care**

Long-term care featured in official government communication, with new measures for the sector announced in broad terms to the general public (sometimes as part of a suite of nationwide measures) and their details communicated through more targeted channels such as sector-specific websites and government agencies with whom the providers typically work with [26-28]. For example, while the reopening of residential and community-based facilities was announced as part of Phase 2 reopening, detailed precautionary measures for the facilities were issued in advisories to the heads of homes and centre supervisors, and posted on the National Council of Social Services’ website. Detailed measures included headcount limits for staff/volunteer-led activities/visitors, split zone/team operations, and guidelines for outreach activities [27, 29].

**Communications on the availability of health services**

The government announced on 12 February that coverage for COVID-19-related inpatient treatment and services would be extended to all patients at public hospitals [30]. On the same day, Singapore’s insurance associations issued a joint statement confirming member companies’ provision of coverage for COVID-19-related hospitalization expenses under their policies. These early efforts helped to address concerns on financial affordability and fewer potential barriers for infected persons coming forward [31]. The provision of subsidized treatment, investigations and medications to patients with respiratory symptoms at Singapore’s network of over 900 public health preparedness clinics (PHPCs)³ was also communicated on 24 February [32], encouraging those who were unwell to seek health-care advice/treatment [2]. Similarly, the availability of swab tests at all

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³ Public health preparedness clinics (PHPCs) are private primary care GP clinics that have been registered and prepared to be activated during public health emergencies to perform roles such as dispensing medications, administering vaccinations, and triaging or supporting acute care hospitals.
polyclinics⁴ and selected private general practitioner (GP) clinics from April 2020 was communicated to the public, together with the preconditions to test, expected wait time for results, and the need for patients to stay at home until the results are communicated to them [33, 34].

Similar communications have been made on health care for other medical conditions. It was announced that health-care subsidies at private GP clinics and use of Medisave⁵ had been extended on a time-limited basis to video consultations for follow up of chronic conditions from 3 April 2020. The uptake and efficacy of telemedicine were discussed on traditional media platforms to generate public awareness and discourse on the nation’s evolving longer-term health-care strategy and delivery model [35-38].

1.2 Physical distancing

Physical distancing measures in the community started in January 2020 with the implementation of 14-day mandatory social distancing, at varying levels of severity, depending on the risk profile of a suspected infection case (see Table 1). Legal enforcement of these orders has been strong, even to the deprivation of permanent residency status, barring of re-entry into Singapore and charging under the ID Act [2]. At the same time, financial assistance was also provided to residents and work-pass holders serving the distancing orders to alleviate concerns regarding impact on livelihood, which could prevent close contacts from coming forward. Self-employed individuals or employers whose employees were serving social distancing orders could claim S$ 100 per day [2, 39, 40].

These distancing orders to individuals were later extended to the suspension of larger group gatherings and communal activities, with the permitted gathering size (number of persons) reduced as the number of COVID-19 cases increased around April 2020 [27, 41-44]. Initial urging of employers by the government to facilitate telecommuting by staff, where possible, eventually became compulsory under the ID Act [45, 46]. Orders were also issued to retailers and food and beverage operators to limit and space out their patrons [47].

As locally transmitted cases continued to rise, with daily new cases moving into double digits and then in the hundreds, the Circuit Breaker involving the closure of most workplaces and full home-based learning for schools was announced on 3 April 2020 [48, 49]. A week into the Circuit Breaker, public transport usage and traffic volume dropped by more than 70%, foot traffic at popular parks/wet markets came down by up to 50%, and close to 80% of the workforce were working from home [50].

In terms of enforcement, nearly 3000 enforcement officers and ambassadors from over 30 agencies were deployed daily to public spaces across the island to ensure that safe distancing measures were observed. Public spaces, including stadiums, playgrounds and fitness corners, were cordoned off to prevent gatherings. Drones were also deployed in selected parks and nature areas to monitor visitors. As of 14 April 2020, more than 6200 warnings and over 500 fines were issued to individuals.

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⁴ Public one-stop health-care centres for general curative treatment, screening, immunization and dental services (for some). These are sited at public housing estates for accessibility to Singaporeans/residents in the community.

⁵ MediSave is a compulsory individual savings scheme for Singapore citizens and permanent residents. It is used for one’s health-care expenditure, and workers and their employers contribute a specified percentage of monthly wages to it. It is mainly for use to cover hospitalization expenses, selected preventive care, and outpatient services and long-term care for certain chronic conditions.
who flouted the safe distancing measures. Consequences for individuals included financial penalties of S$ 300 for the first offence and S$ 1000 for the second offence, and prosecution in court for egregious cases. Meanwhile, the Ministry of Manpower (MoM) and other enforcement agencies carried out inspections and took enforcement actions against non-compliant workplaces. First-time offences by workplaces were issued fines of S$ 1000, with repeat offenders facing higher fines or prosecution in court. Even essential services had to suspend their operations when any of their staff working on the premises became infected [4]. On 23 April, the government announced an extension of the Circuit Breaker period, tighter measures and further closure of less essential workplaces to reduce the proportion of workers still commuting daily to work to around 15% [50].

With community infection rates generally stable, decline in cases among migrant worker dormitories, and no new large clusters emerging, the Multi-Ministry Taskforce announced Singapore’s move to Phase 2 from 18 June, where selected activities and businesses could resume and reopen [20]. With further progress made on adherence to safe management measures, testing capacity and contact tracing, the Multi-Ministry Taskforce announced the further reopening of activities in the community with Phase 3 from 28 December.

See Table 1 for details on the timeline and physical distancing measures effected.

Table 1: Timeline of physical distancing measures and enforcement

<table>
<thead>
<tr>
<th>Date</th>
<th>Physical distancing measures</th>
<th>Enforcement</th>
</tr>
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<tbody>
<tr>
<td>27 January</td>
<td>Leave of absence (LOA) effected. A precautionary measure to prevent the possible transmission of infections. Those on LOA should stay at home, minimize contact with other people in the home, and monitor their health closely. They may leave home briefly to get meals and necessities [13].</td>
<td>Mandatory</td>
</tr>
<tr>
<td>28 January</td>
<td>Quarantine order (QO) effected. Issued to suspect cases and required isolation from other people in the home or in a suitable government facility. A QO is a directive with legal force. It has severe penalties for non-compliance [13].</td>
<td>Mandatory</td>
</tr>
<tr>
<td>5 February</td>
<td>Large group and communal activities were also suspended in schools and social and elder-care facilities [27, 41, 44].</td>
<td>Mandatory</td>
</tr>
<tr>
<td>7 February</td>
<td>Business continuity planning (BCP) and work-from-home guidelines issued. BCP guidelines were issued by government agencies such as Enterprise Singapore for small- and medium-sized enterprises [51]. Similar sector-specific advisories are currently available at <a href="https://www.gov.sg/article/covid-19-sector-specific-advisories">https://www.gov.sg/article/covid-19-sector-specific-advisories</a>.</td>
<td>Recommended</td>
</tr>
<tr>
<td>14 February</td>
<td>GPs to issue 5-day medical leave to patients with respiratory symptoms [52]</td>
<td>Mandatory</td>
</tr>
<tr>
<td>18 February</td>
<td>Stay-home notice (SHN) effected. Stricter than the LOA but one can stay with one’s family members. Those on SHN must remain in their place of residence at all times during the SHN period and avoid interaction with other people in the home. (SHNs were introduced when it was found that some persons issued with LOA</td>
<td>Mandatory</td>
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<tr>
<td>Date</td>
<td>Physical distancing measures</td>
<td>Enforcement</td>
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<td></td>
<td>had continued to go out of their homes regularly and infected a number of new cases as a result.) [12]</td>
<td></td>
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<tr>
<td>11 March</td>
<td>All social activities for seniors organized by government agencies were suspended [42].</td>
<td>Mandatory</td>
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<tr>
<td>13 March</td>
<td>Health and manpower ministries urged employers to adopt telecommuting where feasible [45].</td>
<td>Recommended</td>
</tr>
<tr>
<td>20 March</td>
<td>Suspension of events/gatherings with 250 or more participants [43]. Retailers and food and beverage operators had to put in place markings (for example, on the floor, or on tables and chairs) and limit the number of patrons to ensure sufficient space (at least 1 metre apart) between them [47].</td>
<td>Mandatory</td>
</tr>
<tr>
<td>20 March</td>
<td>Recommendation for seniors to avoid crowded places, stay in well-ventilated areas when outdoors, and engage in more home-based activities [53].</td>
<td>Recommended</td>
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<tr>
<td>24 March</td>
<td><strong>Tighter distancing measures</strong> for the general population:</td>
<td>Mandatory</td>
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<td>• Bars, night clubs, discos, cinemas, theatres and karaoke outlets were closed.</td>
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<td>• Malls, museums and attractions reduced their operating capacity to no more than one person per 16 sq.m of usable space, with groups not exceeding 10 people. Shows, group tours and open atrium sales were suspended.</td>
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<td>• Tuition and enrichment centres were suspended.</td>
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<td>• Religious services and congregations were suspended. Places of worship could stay open for private worship/essential rites, subject to group sizes of less than 10 people at a time.</td>
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<td></td>
<td>• All events and mass gatherings were deferred or cancelled.</td>
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<td>• Private celebrations/gatherings were limited to 10 people or fewer.</td>
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<td></td>
<td>• Funerals and wakes had to limit attendance as far as possible to family members only, and to gatherings of 10 people or fewer at any point [11, 43, 54].</td>
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<tr>
<td>27 March</td>
<td>Patients issued with medical leave certificates for acute respiratory symptoms were asked to self-isolate at home for 5 days [55].</td>
<td>Mandatory</td>
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<td>2 April</td>
<td>Employers had to facilitate telecommuting by staff where possible [46].</td>
<td>Mandatory</td>
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<tr>
<td>7 April</td>
<td><strong>Circuit Breaker</strong> (7 April to 4 May) measures:</td>
<td>Mandatory</td>
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<td><strong>Education</strong> – schools and institutes of higher learning moved to full home-based learning. Preschools and student-care centres suspended services. (Schools, preschools and student-care</td>
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## Physical distancing measures

Centres provided limited services for children of parents who are workers in essential sectors.

**Public** – members of the public were strongly advised to stay home except to purchase daily necessities, or seek essential services or urgent medical care. Reusable masks were distributed to all Singapore residents.

**Businesses/social activities** – all such activities that could not be conducted via telecommuting from home were suspended.

**Attractions/recreation facilities** – all attractions, theme parks, museums, casinos, and sports and recreation facilities were closed. Restaurants/cafes/dining outlets operated only for takeaways.

**Essential sectors** – essential services and those in economic sectors critical for local and global supply chains remained open. Essential services included the following:

- health, social and selected care services;
- energy, petrol and gas services;
- public and private transport services, and logistics providers;
- security, facilities management and critical public infrastructure;
- banking and finance, insurance and asset management;
- food retailers, supply and delivery (open for takeaway and delivery services only);
- water, waste and environmental management;
- information and communications services and providers;
- manufacturing, pharmaceutical and biomedical sciences; others: electricians, plumbers, vehicle repair and veterinary services.

**Across sectors** – fiscal measures to support households and businesses under the Solidarity Package [48, 49, 56, 57]

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<tr>
<th>Date</th>
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<tbody>
<tr>
<td>14 April</td>
<td>For workplace premises that remained open, cross-deployment or movement of workers across different workplace premises (e.g. different branches) was disallowed. No physical interaction was allowed between teams working in different locations.</td>
<td>Recommended</td>
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<tr>
<td>15 April</td>
<td>Employers in essential sectors were required to work out telecommuting arrangements for older workers or redeploy them in roles requiring minimal interaction with others [58].</td>
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</table>
| 21 April | The Multi-Ministry Taskforce announced *extension of Circuit Breaker* until 1 June, allowing fewer businesses to be permitted to operate:  
**Suspend operations of less critical consumer services**: stand-alone outlets that sold only beverages, packaged snacks, confectioneries or desserts were required to close their outlets. | Mandatory |
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<tr>
<th>Date</th>
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<tr>
<td>5 May</td>
<td><strong>Additional restrictions on selected consumer-facing businesses:</strong> businesses such as optician shops, pet supplies stores and retail laundry services could operate by appointment only. Traditional Chinese Medicine (TCM) establishments could open for consultation only by appointment and dispensing of related medication.</td>
<td>Mandatory</td>
</tr>
<tr>
<td></td>
<td><strong>Reduce businesses allowed to operate at work premises:</strong> businesses less critical for daily living/maintaining essential supply chains, e.g. hairdressing and barber services [59]</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Visiting:</strong> one could enter another person’s house only to deliver essential goods/services, provide assistance to a senior/person with disability, or seek help in an emergency. One should not “drop off” their children with their grandparents on a daily basis for childcare needs (exemptions were made for essential service workers and HCWs) [60]</td>
<td></td>
</tr>
<tr>
<td>9 May</td>
<td>Requirements for safe management measures at the workplace issued, including work-from-home being the default mode of working, staggered start times and flexible workplace hours and shift/split team arrangements [62].</td>
<td>Mandatory</td>
</tr>
</tbody>
</table>
| 12 May | Gradual resumption of selected activities and services:  
  • manufacturing and on-site preparation of all food  
  • retail outlets of food, including cakes, confectionery and packaged snacks/desserts (for takeaway/deliveries only)  
  • home-based food businesses  
  • retail laundry services  
  • barbers and hairdressers (basic haircut services only)  
  • retail of pet supplies [63]                                                                                                                                                                                                                         | Mandatory   |
<p>| 2 June | Students resumed school on a weekly rotation schedule; some levels of students went to school for the week while others did home-based learning [64]. People, in groups of up to two visitors, could visit their parents/grandparents living elsewhere. Each household could receive up to only two visitors (who must live together in another house) once a day [65]. | Mandatory   |
| 19 June| Small group gatherings of up to five people allowed. Each household could receive up to five visitors per day [65].                                                                                                                                                                                                                                     | Mandatory   |
| 1 July | Patients aged 13 years and above who presented with acute respiratory infection (ARI) and met the suspect case definition had to undergo a COVID-19 polymerase chain reaction (PCR) swab test. These patients would be required to stay home only until their swab test result was negative [66].                                             | Mandatory   |</p>
<table>
<thead>
<tr>
<th>Date</th>
<th>Physical distancing measures</th>
<th>Enforcement</th>
</tr>
</thead>
</table>
| 19 June     | Resumption of activities from *Phase 2 of Circuit Breaker* (starting 19 June):  
  **Cinemas** – allowed to reopen from 13 July with safe distancing restrictions [67]  
  **Tourism** – permitted to resume operations in stages from 1 July. Domestic tour operators, children recreation areas and hotels (for staycation bookings) could apply to reopen  
  **Public libraries** – reopened from 1 July with shorter opening hours  
  **Places of worship** – permitted to resume congregational and other worship services from 26 June 2020, starting at 50 persons at a time and subject to safe management measures  
  **Public libraries** – reopened from 1 July with shorter opening hours [20]  
  **Education** – students from all levels returned to school daily from 29 June 2020. Institutes of higher learning (IHLs) would progressively increase the number of students allowed back on campus at any one time for face-to-face learning, while maintaining a significant amount of online learning. Schools and campuses would continue to adhere to safe management measures [64].  
  **Dining out** – diners could sit in groups of five or fewer at a table, with tables spaced 1 metre apart [68].  
  **Key life events** – marriage solemnizations/receptions could be held at places of worship and other external venues with a maximum of 20 persons (excluding the solemnizer).  
  For wakes and funerals, up to 30 persons could be present at any one time, subject to the venue’s capacity limit based on safe management principles [69].  
  **Visiting** – one could visit their parents/grandparents, or “drop off” their children with their grandparents, but subjected to limit of up to two visitors from one household each day [70]. | Mandatory    |
| 4 August    | Marriage solemnizations/receptions could be held at a larger variety of venues (both indoor and outdoor) with a maximum of 10–50 persons, depending on the type of venue, its capacity limit based on safe management principles.  
  For wakes and funerals, up to 30 persons could be present at any one time, subject to the venue’s capacity limit based on safe management principles [69]. | Mandatory    |
| 1 September | Public facilities available for those conducting outdoor exercise classes, subject to class sizes of up to 50 people and with safe distancing measures [68] | Mandatory    |
Foreign worker dormitories

As Singapore shifted into the Circuit Breaker, large clusters emerged in foreign worker dormitories. There are about 300 000 migrant workers employed in low-wage jobs (mainly in the construction, marine shipyard and process sectors) living in purpose-built dormitories and factory-converted dormitories across the island [72, 73]. Dormitories were progressively gazetted as isolation areas to stem transmission in the community in April [74, 75]. An inter-agency taskforce was also set up to tackle this situation, and a three-pronged strategy was adopted to contain the spread of the virus in the dormitories, to enforce safe distancing measures on the premises, and to move healthy workers in essential services to other facilities to minimize further cross-infection [76,77].

See Table 2 for lists physical distancing measures implemented as part of this strategy. By end July 2020, purpose-built dormitories, the largest sites for housing migrant workers, saw a 25% drop in occupancy [78]. These accompanied the deployment of medical facilities/ triage clinics to ensure that workers got prompt and adequate medical care, and a broad-based testing strategy to separate infected/suspect cases from uninfected cases (see pages 24 and 32) [76, 79].

Table 2: Timeline of physical distancing measures for the foreign worker population

<table>
<thead>
<tr>
<th>Date</th>
<th>Physical distancing measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>5–22 April</td>
<td>Dormitories with clusters of cases were gazetted as isolation areas under the ID Act, eventually totalling 21 gazetted dormitories [74, 75].</td>
</tr>
</tbody>
</table>
| From 9 April | Distancing measures as part of “dedicated strategy”, with staff from the government stepping in to help dorm operators:  
  - implement safe distancing measures (e.g. workers stay in their rooms and leave their rooms only for essential needs); |
Progressively, migrant workers were considered cleared of COVID-19 infections when they (i) tested negative, or (ii) tested positive but had fully recovered and been discharged, and were residing in accommodation where fellow residents had been cleared of the virus. By 1 June, as Singapore moved into Phase 2, a total of 40 000 migrant workers had been cleared of COVID-19 infections. This increased to 89% of dormitory-dwelling migrant workers by August, and more than 98% by early November [82, 77]. Some “cleared” workers in essential services continued working throughout the Circuit Breaker period, and others were progressively permitted to resume working from June if they, their dormitory operators and employers had made necessary “safe living and working” preparations such as arrangement of staggered pick-up/drop-off timings, updating of workers’ residential addresses on the MoM’s database, and downloading of FWMOMCare and TraceTogether mobile apps for health status reporting and contact-tracing purposes [83-85]. FWMOMCare is complemented by a digital system (AccessCode), which integrates information from multiple government bodies and grants a “traffic light” status on whether a worker can resume work. AccessCode facilitates broad-based monitoring and regulation of workers’ resumption of work [86]. By August, 86% of foreign workers in the construction, marine and process sectors were allowed to resume work [87]. From October, contact-tracing tokens that were purpose-built for the dormitory and worksite environment (compact, water-resistant and able to be worn at all times), were distributed progressively to the workers. These were interoperable with and complemented the TraceTogether app on their smartphones, which they may not always be able to carry with them at work or at the dormitories. By December, these tokens had been distributed to more than 450 000 workers living in dormitories or working in the construction, marine and process sectors [77, 88].

As safe living and safe working measures were being instituted within dormitories and worksites, the workers were progressively permitted to leave their dormitories on rest days to visit designated

<table>
<thead>
<tr>
<th>Date</th>
<th>Event Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>22 April</td>
<td>Daily movement of workers in and out of all dormitories no longer allowed [79].</td>
</tr>
<tr>
<td>20 April to 4 May</td>
<td>180 000 construction work permit and S pass holders (and their dependents) have been placed on mandatory Stay Home Notice from 20 April to 4 May 2020 [79].</td>
</tr>
<tr>
<td>9 June</td>
<td>Foreign workers cleared of virus and fulfilling requirements were permitted to resume work.</td>
</tr>
<tr>
<td>From 1 August (in Phase 2)</td>
<td>Workers cleared of COVID-19 infections were allowed to run errands outside their dorms during staggered rest days and time slots, and with necessary submission of errands/location details by employers/dormitory operators [80].</td>
</tr>
<tr>
<td>From 28 December (Phase 3)</td>
<td>Preparations made to allow workers to visit recreational centres more often in a safe and regulated manner [77, 81].</td>
</tr>
</tbody>
</table>

- reduce the number of workers in each dorm;
- arrange for foreign workers who are not sick and working in essential services to be temporarily housed separately in other accommodation (e.g. military camps, exhibition centres, etc.) from those quarantined in dormitories [76].
locations in the community. With the outbreak in dormitories under control, safe measures instituted at all dormitories and worksites, and a multi-layered and broad-based accompanying testing strategy for the population (see page 24), the government prepared to return the workers to the community in a controlled manner and with strict measures in place [77].

1.3 Isolation and quarantine

Close contacts (those who had been in close proximity – about 2 m – for 30 minutes or more to the infected case) with COVID-19 symptoms are isolated in a separate facility and tested while those without symptoms are served with quarantine orders (QO) for up to 14 days from date of last contact with the confirmed case. Those served with a QO are given the choice of staying at home or staying in a government quarantine facility if his/her home premises are not suitable. Home-based quarantine required those serving the QO to be isolated from others living in the same household with a dedicated room and toilet (compared to those with SHN where dedicated room and toilet is not needed). Moderate-risk contacts (those who may have come into contact with the patient but were not in close proximity or for a prolonged period) were put under phone surveillance but were not made to stay home or be quarantined [40, 89-93].

Those under quarantine are required to monitor their temperature and report their health status to a QO agent at least three times a day. For those serving out QOs at home, spot checks are carried out by officers and if found to be non-compliant, may be required to wear an electronic tag or be detained and isolated in a hospital. Under the ID Act, anyone flouting a QO for the first time may be fined up to S$ 10,000, jailed for up to six months, or both, with higher penalties for subsequent breaches. If the person issued with a QO is an employee, the employer will be informed of the QO by a QO agent, and qualifying employers (self-employed citizens/permanent residents/Singapore-registered companies whose employees under QO are Singaporean citizens/permanent residents/workpass holders) can claim QO allowance (S$ 100 per day) after the employee has completed his/her QO. The person under quarantine receives the QO allowance form at the end of the quarantine, which he/she passes on to the employer to submit to the MoH for processing of the claim.

People serving SHNs (see Table 1) will not require a dedicated room and toilet but should remain at their place of residence at all times and should also not receive visitors at their residence. Similarly, breach of SHN can be prosecuted under the ID Act with first-time offenders fined up to S$ 10,000, jailed for up to six months, or both. Permanent residents and pass holders can have their permits or passes revoked or validity shortened, and students can also face disciplinary action, including suspension or dismissal [94-96].

Travellers who are granted entry to Singapore, with the exception of those from lower-risk countries/regions with which Singapore has special established arrangements (see page 52), are issued SHNs. Travellers can serve their SHNs at a hotel that has been designated as an SHN-dedicated facility, bearing the cost themselves. Depending on the country the traveller departed from and the suitability of his/her place of residence, travellers can also serve their SHN at a place of residence they or their family members own or are the sole tenants of. SHNs for travellers also accompany testing protocols that vary according to their residency status and the country they departed from (see also page 50) [95, 97].
All confirmed infected cases are isolated in public hospitals, isolation wards in a private hospital, community care facilities (CCFs) or community recovery facilities (CRFs). In the earlier months of February to March 2020, all infected cases were isolated at the National Centre for Infectious Diseases (NCID) or another public hospital. These extended to include a wider range of dedicated facilities as COVID-19 patients who were more stable and with milder symptoms were transferred/admitted to CCFs and CRFs from March 2020 (see pages 30 and 40).

Persons awaiting the results of their swab tests were also initially isolated at NCID/public hospitals in the earlier months of the pandemic. They could later do so at swab isolation facilities⁶ (see page 7) and also at their places of residence under the “Swab and Send Home” (SASH) programme as testing capacity and accessibility expanded.

In April 2020, when large clusters emerged in foreign worker dormitories, entire dormitories with clusters of cases were gazetted as isolation areas to prevent COVID-19 transmission to the larger community (see page 15).

1.4 Monitoring and surveillance

The MoH follows WHO’s definition of COVID-19, describing it as “the infectious disease caused by a strain of coronavirus, SARS-CoV” [1]. From 2 January 2020, the MoH has alerted all medical practitioners to look out for suspected cases.

A suspect case of COVID-19 is defined as:

- a person with clinical signs and symptoms suggestive of pneumonia or severe respiratory infection with breathlessness AND who within 14 days before onset of illness had travelled abroad (i.e. to any country outside of Singapore);
- a person with an acute respiratory illness of any degree of severity who, within 14 days before onset of illness:
  - had been to any of the areas requiring heightened vigilance as listed on the health-care professionals portal; OR
  - had been to any hospital abroad; OR
  - had close contact with a case of COVID-19 infection [98, 99].

Close contact was defined as anyone who provided care for the patient, including a health-care worker (HCW) or family member, or who had other similarly close physical contact; and anyone who stayed (e.g. household members) at the same place as a case; and anyone who had close (i.e. less than 2 m) and prolonged contact (30 min or more) with a case (e.g. shared a meal). Criteria and areas requiring heightened vigilance were updated periodically according to new information about the virus and developments in its epidemic spread. For example, areas requiring heightened vigilance extended from provinces within mainland China to the Republic of Korea, and then to parts of Europe as the source epidemic extended to autochthonous infections outside of Wuhan and China.

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⁶ These facilities are for patients awaiting the result of a swab test, to prevent the potential spread of COVID-19 in the wider community [142].
Contact tracing

From February 2020, rapid testing, isolation of cases, contact tracing and quarantine of suspect cases were quickly initiated and scaled up to identify and separate infected individuals from the larger community. Once an infected case is confirmed, contact tracers will interview the patient and map out his/her history of movements over the last 14 days. The contact-tracing team under the MoH comprise communicable diseases and epidemiology experts and volunteers from across various government departments/agencies. They work in teams of 10, two shifts a day, and seven days a week, to verify the information provided through telephone calls and identify close contacts of confirmed cases.

The MoH worked in partnership with the Singapore Police Force to track down contacts that could not be reached or whose identities were not known. Analytic tools helped pick out common keywords from different patients’ activity logs and flagged possible links between cases for further investigation through interviews, ground inquiries, activity mapping, and use of flight manifests and CCTV footages [40, 89-93].

As the number of local cases climbed in the lead up to Circuit Breaker, with daily new cases moving from single digits to double digits and then in hundreds, Singapore’s contact-tracing teams expanded from 3 to 20 to prepare for an expected surge in COVID-19 cases as cumulative cases crossed 500 [93]. Two contact-tracing applications, TraceTogether and SafeEntry, were launched in March and April, respectively, to support Singapore’s contact-tracing efforts. TraceTogether, downloadable as a mobile app or in the form of a token, allows contact tracers to easily identify other users who an infected case has been in close contact with; while SafeEntry is a national digital check-in system that logs the identification and mobile numbers of individuals visiting venues. Both systems work together to increase the speed and accuracy of the MoH’s contact-tracing efforts [100, 101].

The TraceTogether application is contingent on community-driven contact tracing and helps the MoH to “identify people who were in close proximity with COVID-19 cases during the infectious period”. When phones with TraceTogether installed or TraceTogether tokens are in close proximity to one another, anonymised proximity information is exchanged using Bluetooth. This information is stored securely on the phone and shared with the MoH if a user tests positive for COVID-19. As of January 2021, TraceTogether has been adopted by 4.2 million users [102]; and it was reported in November 2020 that about 25,000 close contacts of COVID-19 cases had been identified through TraceTogether [103]. Any Bluetooth data shared with MOH can only be used for the purpose of contact tracing with the only exception being when the data is needed for investigations or criminal proceedings relating to series offences. The MoH has publicly stated that the TraceTogether app will be deprecated after the outbreak [104].

SafeEntry uses QR codes unique to each location, which Singaporeans can scan to indicate that they have been to that particular place [100, 101]. These two technologies work together to improve the accuracy, speed and breadth of Singapore’s contact-tracing efforts. Efforts to integrate both systems are also underway. It was announced in October that integrated use of TraceTogether to fulfil SafeEntry digital check-in will be progressively implemented at popular venues across Singapore by the end of the year [103].
The contact-tracing process, criteria for those deemed to be at risk and monitoring mechanisms are frequently communicated to the public through the MoH’s website, and traditional and social media platforms [89, 90, 103, 105, 106].

**Surveillance and monitoring**

Such contact-tracing measures are part of a broader national and “multipronged surveillance strategy” that include “applying the case definition at medical consults” where regular circulars are issued by the MoH to all medical practitioners with updates on the suspect case definition for COVID-19 and the follow-up triage protocols for possible infected cases [107]. Enhanced surveillance is also applied to certain patient groups – all patients with pneumonia, hospitalized patients in ICUs with possible infectious diseases, primary care patients with influenza-like illness and deaths from possible infectious aetiologies [107]. This includes routinely swabbing patients with influenza-like illness by selected PHPCs (this was part of regular sentinel surveillance but included COVID-19 from February 2020) [108], testing of all pneumonia cases in acute hospitals, and testing of all community-acquired pneumonia diagnosed clinically at PHPCs and polyclinics [2]. The MoH also allows for clinician discretion in the process, granting medical practitioners discretion and the option to order a test based on clinical suspicion, even if the case definition is not met [107].

Surveillance and active case-finding efforts are further bolstered with the use of new surveillance methods and testing strategies (use of rostered routine testing [RRT], controlled and expanded testing accessibility, etc. (see section on “Testing”) to rapidly ring-fence cases of infection. The MoH has piloted/explored wastewater testing. The National Environment Agency (NEA) conducts wastewater testing in densely populated residential premises, such as the migrant worker dormitories. Wastewater testing is currently being implemented at 34 such dormitories [109]. The NEA is monitoring wastewater in other locations and plans to “progressively expand such surveillance to include more workers’ dormitories and other populous living quarters such as nursing homes and hostels” [109].

1.5 Testing

In pre-COVID years, a culture of preparedness had led to the set-up of a new and purpose-built National Public Health Laboratory [110]. At the start of the pandemic, the capability of SARS-CoV-2 reverse transcriptase polymerase chain reaction (RT-PCR) testing was scaled up rapidly from the National Public Health Laboratory to all public hospitals [108, 111]. This was subsequently further expanded through the progressive approval of clinical laboratories to provide RT-PCR testing (also known as PCR testing).

During the COVID-19 pandemic, laboratory testing has been identified as a critical enabler in Singapore’s COVID-19 response, supporting clinical diagnosis so that appropriate treatment can be provided to those who are unwell, and enabling active case-finding and regular community surveillance so that community transmissions can be ring-fenced quickly to prevent the formation of large clusters. To build up Singapore’s COVID-19 testing capacity and to utilize it strategically as a critical national resource, the MoH set up the Testing Operations Centre (TOC) to aggregate the national testing demand and centrally manage the allocation of testing capacity. The TOC works with requestors, prioritizes needs and balances demand across laboratories. This ensures that critical national needs are met, and helps laboratories manage workloads so that capacity is not overwhelmed by sudden surges in demand. Clinical laboratories approved to provide COVID-19
testing need to operate under licensing terms and conditions. These ensure that they conduct COVID-19 testing only for indications and subpopulations/groups permitted by the Ministry, conduct tests in approved operating volumes and commensurate with their resources (e.g. equipment and reagents), and adhere to reporting procedures and prevailing requirements, and biosafety guidelines. (See Fig. 7 for an illustration of the workflow between the TOC, laboratories and requesting institutions [112]).

**Fig. 7: Workflow of the Testing Operations Centre [112]**

In the early stages of the pandemic, PCR tests could be ordered only for cases fulfilling the criteria of a suspect case. Then, tests could be performed only in accredited laboratories, which were mainly public hospital laboratories, and suspect cases had to be sent to hospitals for testing. From April, polyclinics and some private GP clinics could perform the swab tests, and this was progressively extended to more GP clinics and for a wider range of needs basis. (See Table 3 for key stages in the extension of testing accessibility.) From 1 December, the government expanded testing availability as part of efforts to support a larger range of needs as Singapore resumed more economic and community activities, and anyone who required a coronavirus test would be able to get one from an approved provider. COVID-19 tests are now widely available in Singapore, but testing for the “worried well” is not currently allowed, according to the COVID-19 information bot created by gov.sg [113]. However, one who needs a test can visit their GP, who will evaluate his/her contact and travel history and need for testing accordingly. If the patient is deemed to have symptoms suggestive of COVID-19 infection, the GP will perform a swab test at the clinic as long as they are participating in the SASH initiative. If not, the GP will refer the patient to another PHPC where SASH is available for further review by the next day [114]. The targeted testing approach means that people with symptoms or at higher risk of contracting the virus are prioritized for testing.
Table 3: Timeline of stages in extension of testing accessibility

<table>
<thead>
<tr>
<th>Date</th>
<th>Institutions that could order tests</th>
<th>Qualifying needs</th>
</tr>
</thead>
<tbody>
<tr>
<td>From January 2020</td>
<td>Public and private hospitals only</td>
<td>Patients presenting with ARI and who fulfil the MoH’s suspect case criteria [115]</td>
</tr>
<tr>
<td>From April 2020</td>
<td>Public and private hospitals, all 20 polyclinics, selected GP clinics</td>
<td>Patients presenting with ARI and who fulfil the MoH suspect case criteria or SASH criteria [115]</td>
</tr>
<tr>
<td>From June 2020</td>
<td></td>
<td>Patients presenting with ARI and who fulfil the MoH suspect case criteria or SASH criteria</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Members of the public needing to meet specific testing requirements – predeparture/arrival testing for travellers, specific sector workers needing to undergo rostered routine testing (see page 26) Migrant workers returning to work in the construction, marine and process sectors [116, 117]</td>
</tr>
<tr>
<td>From December 2020</td>
<td>Public and private hospitals, all polyclinics and expanded list of approved providers (mostly private clinics and other health-care providers/laboratories). The current list of approved providers is available at: <a href="https://www.moh.gov.sg/docs/librariesprovider5/covid19_test_providers/approved-covid-19-pcr-swab-provider_2_feb.pdf">https://www.moh.gov.sg/docs/librariesprovider5/covid19_test_providers/approved-covid-19-pcr-swab-provider_2_feb.pdf</a></td>
<td>Anyone who requires a COVID-19 PCR test will be allowed to get it done at approved private clinics. As of 1 December 2020, those seeking PCR tests may be companies and those requiring predeparture testing before travelling. For the latter group, approval from the MoH is no longer necessary and they can get tested of their own accord [117].</td>
</tr>
</tbody>
</table>

Expanded accessibility of COVID-19 tests in Singapore has involved the establishment of testing centres in places near work and school. For instance, university dormitories offer free COVID-19 swab tests for residents in an effort to minimize the likelihood of potential cases. When infection clusters arise, the MoH also swiftly quarantines and tests those in close contact with these clusters. The MoH also conducts swab operations to test those at retail sites visited by positive cases. For added convenience, the MoH has set up regional screening centres (RSCs) to conduct COVID-19 testing. These centres are primarily located in accessible locations in the community, such as sports halls, Marina Bay and the Old Police Academy. (Marina Bay is near the heart of Singapore’s financial district and downtown area.) One Farrer Hotel also offers a drive-through testing facility. Both these testing facilities do not accept walk-ins for screening, and require people to consult their doctors before being referred for testing where necessary [118].

At the end of 2020, Changi Airport could handle up to 10 000 laboratory samples by working with external laboratories. A new COVID-19 testing facility has been set up at Changi Airport in early 2021.
to enable arriving travellers to undergo the COVID-19 PCR test smoothly and quickly after disembarkation [119, 120].

Engagement of the private health-care sector has also facilitated the expansion of testing capacity and accessibility in Singapore. With Singapore’s Phase 3 reopening, private clinics and hospitals are preparing to ramp up capacity in anticipation of an expected rise in private sector demand for COVID-19 testing for situations such as return-to-work. The Raffles Medical Group, for example, has launched a Raffles Connect app for customers to book test appointments, make payment and receive PCR test results. It has also invested in increased laboratory capacities that will ramp up daily testing capacity to between 8000 and 10 000 tests [121].


Singapore has been steadily building up its capacity to conduct swab tests for COVID-19. While an average of 2900 tests was conducted per day in early April 2020 [122], Singapore was able to conduct about 13 000 tests a day by June 2020 [123], and more than 27 000 individuals were tested daily as of September 2020 [122, 124, 125]. As of 8 February 2021, the average daily number of swabs tested in the past week was about 34 700. As of 13 July 2020, Singapore conducted about 177 000 swabs per million population [126], and this increased to 1.193 million as of 8 February 2021 [14]. A total of 6.8 million COVID-19 swabs have been tested in Singapore as of 8 February 2021 [14].

**Antigen rapid test**

Use of antigen rapid test (ART) is increasingly being explored to complement the more sensitive but slower PCR tests, and enable more extensive and convenient testing to support reopening of borders and resumption of economic activity. On 12 October 2020, in order to quickly detect and isolate asymptomatic cases among migrant workers, the MoM and MoH started piloting the use of ARTs, which could provide results within half an hour. The new tests will also form part of the existing RRT of workers staying in dormitories [127]. Singapore has also been conducting pilots on pre-event testing using ARTs to enable more large-scale events to resume in a safe manner [128]. Starting 22 January 2021, all cargo drivers entering Singapore from Malaysia via the major checkpoints will be tested using COVID-19 ART [129]. The authorities are also studying the feasibility of introducing less sensitive but quicker tests for travellers from countries deemed to have a lower risk of COVID-19 infection [119]. The list of MoH-approved providers for ART tests is available at https://www.moh.gov.sg/licensing‐and‐regulation/regulations‐guidelines‐and‐circulars/details/list‐of‐covid‐19‐swab‐providers

**Serology tests**

In view of the limited sensitivity of serology tests during the initial weeks of the illness, the national position is that serology tests have no role in the clinical diagnosis of recent-onset COVID-19 infections. Given the limited knowledge on serology tests and their period of limited sensitivity in the early months of the pandemic, the initial guidance then was that it should not be used for any form of clinical diagnosis of COVID-19 infection. Use of serology tests was then explored in local seroepidemiological studies and piloted in a testing exercise (coupled with PCR testing) within the migrant worker dormitories (see below). With more concrete understanding of its reliability and limitations, from June 2020, national guidance permitted the use of serology tests to determine past
infections, especially for predeparture or RRT. Accompanying guidance on the required days of isolation (stay-at-home medical certificate) for serology-tested positive cases, which varied as understanding of the tests evolved, was also provided to medical practitioners [130-133].

**Targeted testing of “higher-risk” groups**

Testing is also used in a targeted way for selected population groups. These include health-care personnel, care staff at nursing homes, frontline officers managing COVID-19 cases and dormitory-based migrant workers. In April 2020, “health-care workers, staff in nursing homes and other workers in essential services, in particular those working with vulnerable groups”, got tested for the virus first. The rationale was to ensure the well-being of Singapore’s core workforce and also to protect the more vulnerable members of society. This was also part of Singapore’s broader national strategy to move out of the Circuit Breaker in a cautious and sustainable manner [134]. Singapore’s universal testing of nursing home staff was cited as a success story in a review article for the low transmission rates and deaths recorded in nursing homes as in June 2020 [135]. Use of new methods, such as pooled testing and introducing robots to conduct swab tests so as to reduce the risk of transmission for medical personnel, were also piloted and explored [124].

A multilayered and broad-based testing strategy was also part of the response strategy to tackle the large outbreak of COVID-19 in migrant worker dormitories in April. By August 2020, migrant workers residing in all dormitories had been tested for COVID-19 at least once, allowing most of them to resume work [77]. From June 2020, the MoM started to systematically test migrant workers living in dormitories, whether symptomatic or not, by coupling serology and PCR testing. In dormitories with a high incidence of infections, workers were screened with a combination of serology as well as PCR tests:

a. If the workers tested serology-positive, it meant that they had been infected earlier. These workers underwent a seven-day period of isolation, at the end of which the MoM could be confident that they were no longer infectious, and did not need to be tested further.

b. Those who tested serology-negative were separately isolated for a longer period of 14 days, in case they were incubating the virus despite being asymptomatic. They were given a PCR test at the end of the isolation period to confirm that they were free from infection [77].

For the marine and offshore sector, under the COVID-Safe Restart Criteria for Shipyards, resident contractors and common contractors (marine and offshore) released on 2 June 2020, employers were to ensure that all employees undergo RRT every 14 days, with the exemption of non-dormitory workers working in non-production sites or those working from home [136].
2 Ensuring sufficient physical infrastructure and workforce capacity

2.1 Physical infrastructure

*Quarantine/isolation facilities*

Singapore’s limited land availability means that being able to repurpose spaces and optimize land use has been a priority. The spike in COVID-19 cases in foreign worker dormitories presented challenges in testing, quarantine and isolation operations. Broad-based and mass testing techniques were adopted, and isolation was carried out of entire dormitories and movement of mildly symptomatic workers to other repurposed isolation facilities (e.g. exhibition centres) and accommodation (e.g. military camps).

To meet the demand for quarantine operations, Singapore has also repurposed more than half of all hotel rooms to serve as isolation/quarantine facilities and accommodation for returning residents/travellers serving their SHNs [137, 138].

Singapore has also readily converted other multiple locations for quarantine facilities. For instance, in the National University of Singapore, several blocks of student housing have been converted to quarantine zones. Students vacated their rooms within one day, quickly freeing up room for inbound travellers and probable cases who needed to be quarantined. Other repurposed government quarantine facilities include retreat sites for gatherings or stayovers with family and friends, such as the Heritage Chalet in Pasir Ris, SAF Changi Chalets and the HomeTeamNS Sembawang Chalets [139].

The culture and practice of pandemic readiness in pre-COVID years had spurred the design and set up of the NCID in September 2019, a 330-bed purpose-built facility whose capacity could be increased to 500 beds, and with integrated clinical, laboratory and epidemiological research functions. NCID and its neighbouring hospital have been managing up to 70% of the national COVID-19 patient workload. Since 2014, all public acute care hospitals had also been undergoing national simulation exercises of outbreak situations to train for pandemic preparedness and the expansion of isolation capacity [110, 140]. These prepared the hospitals, which were able to switch from “peacetime” to “outbreak” mode quickly in the COVID-19 pandemic, to scale down from “business as usual” work and increase the capacity of beds, ventilators, personal protective equipment (PPE), drugs, etc. and human resources for COVID-19 testing/treatment. Normal wards were converted to COVID-19 wards once NCID capacity was reached [40, 110, 111, 141].

In the Singapore General Hospital, for example, the Ward@Bowyer (the newest ward built on a former car park) was added on to the hospital’s isolation ward at the height of Singapore’s outbreak in April 2020. This enabled the hospital to take in 200–300 COVID-19 cases during the period [111].

Collaborations were also established with private and community hospitals, and non-health-care entities (such as exhibition centres) to convert their wards or spaces to isolation and care facilities in the community. These facilitated the transfer of mildly symptomatic patients who did not require hospital care to these facilities, reducing the patient load in hospitals. Singapore’s health-care systems have not been overwhelmed since the start of the COVID-19 outbreak [40, 110, 111, 141].

The conversion of hotels and recreation centres into swab isolation facilities (SIFs), which are facilities for patients awaiting the result of a swab test, was also done to prevent the potential spread of COVID-19 in the wider community [142].
As of 28 April 2020, there was a capacity of 4000 beds in SIFs in locations such as hotels and the Civil Service Club. CCF capacity had also rapidly increased, following the spike in cases in foreign worker dormitories. CCF capacity, which started with around 500 beds at D’Resort NTUC, grew to about 10 000 spaces by end April, in places such as the Singapore EXPO and Changi Exhibition Centre [143]. Specifically, the 10-hall 100 000 sq.m Singapore EXPO space was used to establish “8000 beds, medical consultation rooms, pharmacies, 150 self-monitoring stations, shower and toilet facilities, WiFi access, self-monitoring stations, and laundry facilities”. For the first month, between 10 May and 9 June, clinicians observed “3758 patients admitted to the facility. Daily admissions were 121.2, while discharges were 124.4 – giving them a mean bed occupancy count of 2593.5 at a time” [143, 144].

In addition, with the shift to a time-based discharge criterion (see page 38), patients who remained well at the end of day 14 after diagnoses and who did not require further medical care, were moved to a step-down CRF, converted from various Singapore Armed Forces (SAF) camps [142, 143]. As of April 2020, there was a capacity of over 2000 beds in CRF sites, with plans to scale up to more than 10 000 beds by end June [143].

**Public health preparedness clinics**

A network of private primary care clinics, the PHPCs, had been registered in pre-COVID times and were prepared to be activated during public health emergencies to perform roles such as dispensing medications, administering vaccinations, and triaging or supporting acute care hospitals. During the COVID-19 outbreak, the PHPCs helped to screen and triage cases to the hospitals for diagnostic testing and isolation. From June, they also supported the nationwide effort of diagnostic testing of suspect cases and those who needed to test (see page 21). More recently, they are roped in to support the national vaccination programme. As a network, PHPCs play an important role in supporting activation of additional health-care resources and infrastructure during the outbreak to enhance surveillance capacity and management of possible cases in the community [2, 110].

**PPE and medical supplies**

In terms of health-care supplies, prior to the pandemic, the government had ensured adequate national stockpiles of PPE and essential medicines for up to 6 months [40, 111, 146]. To facilitate the importation of medical devices, including PPE, masks and thermometers, the HSA allowed waivers on importers’ licences to meet the increase in local demand since 31 January 2020 [147]. Concurrently, in view of the global shortage, local researchers and manufacturers participated in their local production, initiating mask manufacturing and donations to increase mask supplies [148]. For example, Singapore’s Defence Science and Technology Agency (DSTA) created a specialized face shield for frontline workers. DSTA also worked with a local medical device manufacturer to produce the face shields and supplied them to various public agencies [149]. Some local private companies also initiated mask manufacturing lines [148]. In February, when it was difficult for providers to secure new shipments of PPE items, the MoH distributed PPE on a regular basis to the GP clinics islandwide [150]. In a ministerial statement in October, it was explained that Singapore was able to enter the pandemic with sufficient medical supplies and essential goods for the public and HCWs as a strategic national stockpile was in place. This was further supported by “a combination of local production of essential supplies, and a diverse network of trading partners” [151].
2.2 Workforce

Planning and redeployment

Efforts were made to meet the surge in demand for HCWs. Collaborations were established with the private sector to increase surveillance, testing and isolation capabilities. Singapore’s network of PHPCs enabled the swift activation of nationwide surveillance and detection from the start and over the course of the outbreak (see pages 20 and 30). As early as March 2020, the MoH had also tapped into private sector hospital capacity to help care for existing patients with chronic medical conditions and transfer COVID-19 patients who were "well and stable" for monitoring and isolation. This freed up capacity in the public sector to manage more severe COVID-19 cases [152]. The progressive extension of the availability of swab tests/serological tests at GP clinics and private hospitals, and gradual expansion of a network of licensed testing laboratories (see page 21) also allowed the government to tap existing private sector human resources to scale up testing capacity [117].

During the Circuit Breaker, when intermingling of households was disallowed (see Table 1), essential workers and HCWs who were unable to work from home were allowed to depend on grandparents for childcare arrangements. The flexibility was introduced to facilitate the smooth continuation of health-care workforce availability during the Circuit Breaker period [153].

Containment and management of the large clusters that emerged in migrant worker dormitories in May 2020 required significant health-care resources. Volunteers were recruited to form medical teams that went into the dormitories to assist in testing and implementation of safe management measures. For example, nursing students from the National University Health System responded to the MoH’s call for volunteers, and undertook serology testing of migrant workers at dormitories with higher levels of infection [154].

The SAF also participated in the COVID-19 containment efforts in migrant worker dormitories. In April 2020, the SAF deployed 70 of their medical personnel to migrant worker dormitories that housed more than 20 000 workers [155]. The SAF medical personnel formed forward assurance support teams (FAST) to manage the daily needs of the isolated migrant workers, such as ensuring that their meals were delivered on time and that their well-being was maintained [156].

With the contraction of the global aviation industry, opportunities were created for airline crew to be directed to appropriate training and subsequent jobs in supporting roles in hospitals and the public health response. The supporting roles in hospitals involved providing administrative support and attending to non-COVID patients who required routine medical care in a non-clinical role, such as repositioning patients in bed, monitoring their vital signs and noting meal orders [157]. This helped to lighten the workload of nurses and other hospital staff who could focus on the COVID-19 patients. By May 2020, Singapore Airlines had committed to “provide at least 300 care ambassadors, 500 transport ambassadors and 150 contact-tracing ambassadors, and continues to work with other organizations to explore other avenues where its employees can help” [158]. From September 2020, opportunities were also created for Singapore Airlines cabin crew members to work at a nursing home as "care ambassadors", assisting senior residents in their basic daily activities [159].

Concurrently, over the course of the pandemic, the MoH has also been conducting open calls for nurses who are not practising, practising as an agency nurse, or in a non-nursing related area, to support the health-care workforce by helping out in non-COVID capacity [160].
At the same time, appropriate training was provided to nurses from non-COVID wards who were redeployed to care for COVID patients. For example, in April 2020, Tan Tock Seng Hospital trained more than 380 nurses to support operations at the NCID, which expanded its capacity from 330 to 586 beds. The newly deployed nurses had to undergo special training, such as the handling of patient specimens or safe transportation of patients [161].

With the need for strong enforcement of infection control measures in health-care institutions, workflow changes involving precautions such as PPE use and regular disinfection of the equipment/environment were also implemented across non-COVID wards. These also necessarily accompanied training of staff working in a non-COVID capacity [162].

With the gradual reopening of borders from June 2020, enhanced measures were set out for HCWs returning to Singapore from overseas, regardless of the scheme they had travelled under (e.g. Reciprocal Green Lane arrangements (see page 50). These included restriction of their duties to non-patient-facing work for up to 14 days from their date of return (actual days of non-patient-facing work depended on their days of SHN, which depended on the country they had travelled from). HCWs do not need to undergo additional swab tests on top of the prevailing requirements when returning to Singapore from their respective countries of travel [163].

To strengthen infection control surveillance, some hospitals set up dedicated teams to monitor HCWs’ sick leave records for indications of increase in absenteeism and possible clusters of upper respiratory tract infections. Additional physical distancing measures where HCWs were divided into smaller care teams responsible for dedicated patient groups were also instituted [164].

Impact on medical/nursing students

Infection control and workforce planning measures impacted the education, training and placement of medical/nursing students to a certain degree. Singapore’s postgraduate medical training is modelled after the US residency training system. Measures to minimize unnecessary contact between HCWs and directives to step up human resources at health-care institutions impacted residency training by way of delaying specialist accreditation for final-year senior residents (with postponement of examinations). It also affected training in programmes involving rotations across multiple subspecialties in different institutions (with cessation of cross-institutional rotations), preventing achievement of target case log numbers (with cancellation of non-urgent surgeries and outpatient clinic visits), and redeployment to outbreak management roles [165]. A survey seeking to understand the impact of COVID-19 on residency training observed that 61% of survey respondents agreed that the current outbreak had adversely affected their training and/or career [166].

There is currently an increased focus on residency programmes and institutions to manage anxieties caused to trainees by the outbreak and the resultant disruption to their education. Emerging academic articles have proposed that “personnel rosters and work schedules for deployed residents should be overseen with care to ensure trainees do not spend excessive amounts of time away from core work that is specific to their training” [166].

Singapore also suspended clinical attachments for medical, nursing, pharmacy and allied health students enrolled in tertiary institutions in February 2020, and lifted the suspension after 3 months, nearing the end of the Circuit Breaker. This was done for safety reasons and to minimize exposure of students to the virus. Students largely volunteered in their personal capacities during the period. HealthServe, a non-profit organization of volunteer doctors providing medical care to migrant
workers, received large numbers of student volunteers, which enabled it to keep their clinics for migrant workers running. Universities and hospitals later devised “coordinated preparation plans and strategies” to “safely resume clinical placements within national and hospitals’ risk control measures against COVID-19 transmission” between February and May. For example, a contingent module was quickly developed and launched to replace on-site community pharmacy training requirements in the Department of Pharmacy, National University of Singapore, paving the way for uninterrupted completion of pre-employment clinical training for interns’ graduation and progress on to pre-registration pharmacist training [167, 168]. Elective programmes for medical students who are currently overseas, and attachment programmes for Junior College-level students/pre-university entrants who are interested in finding out more about the medical/allied health education and profession, have been suspended (since February 2020) until further notice [169, 170].

Support for HCWs

The MoH has publicly emphasized the heavy workload and stress HCWs faced during the pandemic. The increase in patient load with COVID-19 meant that some were taking on longer shifts, while others were required to take on additional roles. A March 2020 statement by the MoH stressed that health-care institutions were to make sure that their staff were well-rested and put in place a series of measures to reduce staff burnout, such as counselling services and peer support programmes [171]. Hospital support helplines were readily available and information on how to access support was publicized via emails and posters in the hospital environment. Arrangement of on-campus accommodation was also offered to residents who were concerned about possibly infecting their family members and felt that they needed to isolate themselves from their families during the period [164, 165]. Human resource support was rendered through internal staff redeployment, such that staff from services with decreased workloads (e.g. due to the postponement of elective services) were redeployed to services with increased workloads (e.g. emergency department [ED], respiratory medicine, etc.). This helped to balance workloads between services and prevent staff burnout. Temporary staff were also recruited to augment existing staff. Adequate supply of PPE to staff was ensured to provide reassurance of protection against unnecessary virus exposure. At the hospital level, regular and supportive communications in the form of weekly CEO email memos to staff, sharing of staff narratives/interviews on their experiences, regular CEO dialogue sessions with staff/head of departments, and display of gifts of appreciation from the public, were carried out to encourage staff and build a sense of shared purpose and resilience [161, 172, 173]. On a national level, Clap for #SGUnited campaigns were organized, where Singapore’s residents showed their appreciation for health-care and frontline workers by applauding from their windows at pre-scheduled timings [174].

There are as yet no publicly announced targeted mental health programmes/support measures for female or other specific health-care workforce groups. A recent local study observed that women HCWs faced higher exhaustion scores, likely due to longer work hours and travel restrictions that limited their return to their families. It pointed out that female-dominated health-care roles included nurses (88.4%), allied health-care professionals (73.7%) and administrative professionals (71.1%), and recommended special attention be paid to these groups when implementing supportive measures for the health-care workforce [175].
3 Providing health services effectively

3.1 Planning services and maintaining essential services

Following severe acute respiratory syndrome (SARS) in 2003 and then H1N1 in 2009, Singapore had been systematically strengthening its ability to manage another emerging infectious disease outbreak [176]. Since then, Singapore had developed a national pandemic preparedness plan, which included the construction of the NCID (see page 25). The NCID was officially opened in September 2019 [40, 108, 110] and, since 2014, all public acute care hospitals had also been undergoing national simulation exercises of outbreak situations to train for pandemic preparedness and the expansion of isolation capacity [2].

The network of PHPCs had also been registered and prepared in pre-COVID times to be activated during public health emergencies to support health services in the response (see page 26). In January 2020, the MoH reviewed the plan for PHPCs and polyclinics, and availability of PPE and masks [177]. On 18 February, the network of PHPCs was activated to work alongside the polyclinics [2, 40, 108]. PHPCs performed roles such as screening and referring cases to hospitals for diagnostic testing and isolation, advising patients with mild influenza-like symptoms to isolate at home, and providing subsidized treatment for respiratory illnesses (under the Flu Subsidy Scheme [FSS]) [40]. Some of these clinics had also been routinely swabbing patients with influenza-like illness as part of regular sentinel surveillance. In March, such national surveillance was enhanced from 30 to 90 clinics with the introduction of swab testing for COVID-19 in more PHPCs (SASH) to detect community transmission. In April, this SASH programme was expanded to 198 clinics [177].

In accordance with the comprehensive medical strategy for COVID-19, new capacity in isolation wards and ICUs have been created by repurposing existing beds/hospital facilities and acquiring additional medical equipment [143]. The pre-COVID national simulation exercises had also prepared public hospitals to be able to expand isolation capacity quickly. Management of COVID cases was originally centralized at the NCID and its neighbouring hospital earlier on in the pandemic. Normal wards in public hospitals were later converted to COVID-19 wards once NCID capacity was reached [40, 110, 111]. To scale up COVID-19 treatment capacity and maintain care for existing patients with chronic medical conditions, public hospitals established collaborations with private health-care providers in March [141, 143]. Private hospitals supported public hospitals by admitting and treating COVID-19 patients with less serious acute clinical conditions, as well as helping to care for existing patients with chronic medical conditions. To further facilitate efficient use of hospital resources, the MoH announced on 24 March that patients who were well enough to be discharged from medical care but still tested positive for the virus would be moved to CCFs. CCFs are large-scale institutional isolation units (converted from public spaces such as exhibition centres) supported by telemedicine and a low health-care worker–patient ratio [178, 179]. At the same time, the government worked collaboratively with private hospitals to staff the CCFs with the necessary HCWs (doctors, dentists, health-care assistants, etc.) [180]. With the execution of its national medical strategy for COVID-19, Singapore has not seen the overwhelming of its health-care systems since the start of the COVID-19 outbreak [40, 110, 111].

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7 A study estimated the health-care worker–patient ratio to be 98 health-care workers for 3200 beds [179].
To ensure that there is available hospital capacity to care for COVID-19 patients, on 6 April 2020, in conjunction with start of the Circuit Breaker, the MoH issued notice on compliance with safe distancing measures and the deferment of non-essential services to all health-care institutions and practitioners. Guidance on what constituted essential and non-essential services, and which community care services could continue to operate, was provided by the MoH [181] and are available at https://www.moh.gov.sg/news-highlights/details/continuation-of-essential-healthcare-services-during-period-of-heightened-safe-distancing-measures. These measures were incorporated under the COVID-19 (Temporary Measures) Act and Regulations 2020 and the MoH Health Regulation Group enforced their compliance [182]. Consequently, during the Circuit Breaker, hospitals postponed non-urgent elective procedures and could attend to only acute conditions. To maintain core health service capabilities while encouraging safe distancing and infection control practices, the MoH encouraged health-care institutions to start teleconsultation services for follow-up care [143]. Doctors providing teleconsultation services had to attend a telemedicine e-training course and adhere to the National Telemedicine Guidelines (issued in 2015). By 13 April, 955 medical practitioners and health-care staff had completed the government-mandated telemedicine e-training course, and 115 clinics had been approved to provide Medisave-claimable video consultations [183]. The private medical community also initiated/expanded efforts in telemedicine. Doctor Anyway, a regional on-demand video consultation platform connecting patients to doctors for medical consultations, saw a 60% increase in its panel of GPs from Singapore. Getting medications to patients was done through the use of third-party dispatch service providers, clinic dispatch services, or having patients’ family members pick up their medications [183]. At hospitals, outpatient clinic appointments of patients with chronic conditions were postponed during the Circuit Breaker, except for cases that required immediate medical attention [184]. Provisions were made for these patients to refill medication for chronic illnesses without clinic consultation and through home delivery [185].

As the Circuit Breaker ended on 1 June 2020, there was gradual resumption of health services through three phases. In Phase 1 (from 1 June 2020), health-care providers had to triage and prioritize the resumption of health-care services based on medical necessity. For hospitals, only specialist outpatient services, medical procedures and allied health services for patients with higher needs could resume. Primary, preventive and dental care facilities, chronic disease management, including the provision of ancillary services, could resume for patients, prioritized by health-care providers based on medical necessity and available capacity. This included vaccination and pre-enlistment screening. Ongoing dental procedures (scaling, fillings, crowns, etc.) could resume with appropriate precautions. For community-based health services, home-based visits could resume for existing clients needing the services with safe distancing measures in place. Listing of examples of services that could continue during the Circuit Breaker period and in the lead-up to and during Phase 1 can be found at https://www.moh.gov.sg/docs/librariesprovider5/pressroom/press-releases/annex-a-essential-services-that-have-not-been-deferred-during-circuit-breaker-period.pdf and https://www.moh.gov.sg/docs/librariesprovider5/pressroom/press-releases/annex-b-essential-services-for-resumption.pdf, respectively.

Most health-care services resumed by Phase 2, with services for medically necessary treatment prioritized. Services allowed to resume included recommended screening for chronic disease and cancer, statutory and pre-employment medical examinations, and selected community-based services delivered on a one-to-one basis. Resumption of these services was subject to the need to
minimize physical visits whenever possible, with teleconsultation and medication delivery being the preferred mode of review [186].

**Vulnerable populations**

The government also prioritized improved access to COVID-19 services for vulnerable populations, especially for migrant workers and senior citizens. During the period when all foreign worker dormitories were placed under isolation, workers who were sick and presented with symptoms of ARI were isolated and treated [77, 187]. The MoH and MoM distributed thermometers and >25 000 oximeters to complement testing and identify potential new cases quickly [77]. Every migrant worker from the dormitories had to check and report his temperature and oximeter readings twice a day to medical teams [77]. By the end of April, medical support was set up at the dormitories to provide health services to migrant workers who were unwell [77]. This included medical posts with teams of doctors, nurses and technicians at all 43 purpose-built dormitories (PBDs), as well as eight medical posts with roving medical teams for non-PBDs. Migrant workers living in the community had access to the nationwide network of more than 900 PHPCs and polyclinics. Concurrently, as evidence of asymptomatic transmission and transmission from never-symptomatic cases emerged, a broad-based and systematic testing strategy with the use of both PCR and serological testing enabled more accurate and targeted isolation of infected workers, such that those who were previously infected but were no longer infectious, and those who had never been infected, could be differentiated from those who were currently infectious (see page 24). After containment of the spread of COVID-19 in the dormitories, the focus shifted to clearance of infection in the dormitories, and the establishment of comprehensive preventive structures to facilitate safe resumption of work by the workers (see page 15). These included establishing medical support plans for migrant workers after the dormitories were cleared of the virus. In August 2020, the government launched a three-pronged medical support system for migrant workers, which consisted of development of dedicated medical centres islandwide, accessibility to telemedicine via the FWMOMCare mobile application, and mobile clinical teams that could be activated for quick intervention in the event of emerging clusters [188, 189]. From June to November, migrant workers staying in dormitories were progressively cleared to resume work (see page 15) and, since October, the number of new infections detected in the dormitories has remained very low [77].

In Singapore, on May 2020, nearly one in six (16%) seniors who were infected with COVID-19 suffered from severe symptoms and required intensive care in the hospital [190]. In addition, 95% of all deaths due to COVID-19 in Singapore involved seniors. To protect vulnerable seniors and reduce the likelihood of COVID-19 occurring in residential care homes, the Multi-Ministry Taskforce implemented measures to safeguard the health and well-being of senior citizens. Since January 2020, a range of preventive measures were instituted in the homes, including heightened infection control and prevention practices, access to a steady supply of PPE for nursing home staff, safe distancing measures, split-zone arrangements, and suspension of visitors [190, 191]. The MoH, the Agency for Integrated Care, and the Ministry of Social and Family Development (MSF) also initiated widespread testing for all 30 000 residents and staff of nursing homes, welfare homes, sheltered homes and adult disability homes from April to June 2020 to detect COVID-19 infections [190, 192, 193]. Where there was a positive case in the homes, the task force prioritized support for them to thoroughly disinfect affected areas, conduct contact tracing and quarantine close contacts [190, 194]. From June, all homes/centres that were closed during the Circuit Breaker period could reopen.
for service users with moderate-to-high needs while ensuring compliance with safe management measures and minimal staff strength on-site [195]. Some senior-centric activities could resume with complementary preventive measures. These included size and duration limits for group- and volunteer-led activities. Visits with limits on duration and visitor number could also resume for homes serving non-elderly residents [191]. Starting from 19 June 2020, visits to nursing homes could resume. All nursing homes would need to put in place additional precautionary measures to protect their residents. These included safe distancing, limiting group interactions, visitor control, setting aside dedicated visitation areas, and ensuring good infection control practices such as hand hygiene and wearing of masks [196]. Size and duration limits for visits, outings and group activities gradually eased with Phase 2 and then Phase 3. Details of relevant measures for the long-term care sector and how they varied over the post-Circuit Breaker phases can be found in the advisories issued by the MSF and are available at https://www.ncss.gov.sg/Press-Room/COVID-19/Past-COVID-19-Advisories.

3.2 Managing cases

*From point of first contact with patients with ARI*

From 2 January 2020, all medical practitioners had been alerted to look out for suspected cases according to the suspect case criteria issued by the MoH (see page 20). All clinic attendances should be provided with screening questions on travel history and respiratory symptoms, and cases presenting with ARI symptoms and fulfilling the suspect case criteria should be referred to the ED/PHPCs for further triage. For patients presenting with ARI symptoms at the PHPCs or polyclinics, the following were done [2]:

- patients who were medically unstable with severe ARI symptoms should be referred to an ED via ambulance;
- patients with mild respiratory symptoms who fulfilled the suspect case criteria should be sent directly to the NCID or acute hospitals [177];
- patients with mild ARI who did not fulfil the suspect case criteria should be provided with 5 days of stay-at-home medical leave. If the symptoms worsened, patients were advised to return to the same doctor for evaluation and referral for testing [2, 55, 108, 177].

Variations and fine-tuning of the above protocols were done to tighten or refine the case management structures as the pandemic situation evolved and reduce disruptions to workplace operations as testing capacity increased. From April 2020, a web-based COVID-19 Symptom Checker was also launched to support the public in navigating care options based on their symptoms, age and travel history [40, 197]. The timeline of adjustments to triage protocols are listed in Table 4.

*Table 4: Timeline of workflow changes to patient triage*

<table>
<thead>
<tr>
<th>Date (wef)</th>
<th>Workflow changes to patient triage</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 March</td>
<td>Dental clinics, practitioners and oral health therapists instructed to refer all patients presenting with ARI (whether fulfilling the suspect case criteria or not) to PHPCs/polyclinics for medical assessment and follow up. Patients with ARI (whether fulfilling the suspect case criteria or not) and requiring urgent/emergency dental management to be referred to designated hospitals for treatment [198]</td>
</tr>
<tr>
<td>Date (wef)</td>
<td>Workflow changes to patient triage</td>
</tr>
<tr>
<td>-----------</td>
<td>----------------------------------</td>
</tr>
<tr>
<td>27 March</td>
<td>Medical practitioners asked to emphasize legal enforcement of 5 days’ medical certificates (MCs) for stable patients presenting with any degree of ARI and not fulfilling the suspect case criteria [55]</td>
</tr>
<tr>
<td>1 June</td>
<td>Guidance issued to medical practitioners on evaluation of patients with a history of COVID-19 infection and presenting with ARI, and protocols on testing and triaging [199]</td>
</tr>
<tr>
<td>1 July</td>
<td>Implementation of enhanced SASH criteria for clinics participating in the SASH initiative to include patients with ARI &gt;13 years of age, persons working and/or living in communal settings (e.g. residential, custodial or special care facilities), and immunosuppressed patients. See Fig. 8 for the workflow [200].</td>
</tr>
</tbody>
</table>

ARI: acute respiratory infection; PHPC: public health preparedness clinic; SASH: Swab and Send Home (programme)

As the network of clinics participating in SASH expanded, the predominant triage workflow evolved to be test-based, with the majority of persons presenting with ARI needing to undergo a PCR swab test, and requiring to stay home only until their test results were negative. (See Fig. 8 for the current patient triage workflow.)
Vulnerable populations/higher-risk groups

Additional directives or protocols are applied to vulnerable/higher-risk groups to tighten the existing surveillance and triage structures in the community. Directives are issued to long-term care residential homes to ensure that staff or residents with ARI symptoms sought medical advice from the nearest PHPC or polyclinic immediately. Following a confirmed case, homes have to immediately prepare information on the case’s health history, date of symptom onset, location of bed/areas visited two days prior, and staff/visitors/residents who have been in contact with the case [27, 195].

Similarly, senior citizens and migrant workers living in the community have access to the nationwide network of more than 900 PHPCs and polyclinics [77]. The health of migrant workers living in dormitories is monitored through the FWMOMCare App, which facilitates prompt medical attention with its 24/7 telemedicine service for those who were unwell. Employers are also tasked to ensure that unwell workers seek medical attention and, where necessary, to work with dormitory operators
to book an appointment and arrange for transport for them to visit the nearest dedicated medical centre [188, 201]. These medical centres treat all migrant workers for a range of conditions, including ARIs, and refer patients requiring specialist care to appropriate care providers for further management [188]. Migrant workers in dormitories are tested by dormitory medical teams, SIFs or screening centres in acute care hospitals [177].

Treatment at hospitals

In Singapore, the majority of cases are isolated and treated at the NCID. Its capacity increased from 330 to over 500 during the outbreak and, together with its neighbouring hospital, has been managing up to 70% of the national COVID-19 patient workload [40, 108, 110]. In the NCID, patients are admitted to individual negative-pressure isolation rooms and are reviewed daily by medical teams [202]. At public hospitals, all admitted suspected COVID-19 cases receive a chest radiograph and RT-PCR testing from respiratory specimens over two consecutive days [107, 111]. To monitor patient parameters, the ViSi Mobile® wearable continuous patient monitoring system is used, which also reduces exposure risk for HCWs and their PPE consumption [202]. Complete blood count, kidney and liver function tests, C-reactive protein and lactate dehydrogenase levels are analysed as part of standard investigations [202].

Treatment guidelines for COVID-19 were developed, provided by the NICD on 4 January 2021, and regularly updated since. Recommendations for each treatment were based on analysis of published clinical trials, cohort studies, society and professional guidelines related to the treatment of COVID-19, discussion with an expert committee, and screening for conflicts of interest [203]. Clinical evidence summaries for various therapeutics for COVID-19 from the MoH-Agency for Care Effectiveness are also available at https://www.moh.gov.sg/covid-19/clinical-evidence-summaries [204].

According to this treatment guideline, the cornerstone of clinical management of COVID-19 is early supportive care and monitoring, including oxygen supplementation, organ support and prevention of complications, especially acute respiratory distress syndrome (ARDS), organ failure and secondary nosocomial infections [204]. As such, most COVID-19 patients do not need specific antiviral treatment. However, patients who progress to more severe disease may benefit from treatment with medications that have antiviral and/or immunomodulatory activity [204]. Although there was no proven or licensed therapies for any coronavirus (CoV) infection as on April 2020 [203], there are currently more meta-analysis data on corticosteroids for the treatment of severe COVID-19 and remdesivir has been approved by the HSA for use in hospitalized patients with severe COVID-19 [204]. Convalescent plasma is available in Singapore as part of a monitored expanded access programme. The current guidelines (as of January 2021) restrict its use in the context of contraindications to other approved medication and as salvage therapy [204].

In hospitals, to provide proper treatment of COVID-19 infection, persons are classified as being at low versus high risk of disease progression for COVID-19, which is important in helping to prevent worsening of the disease in high-risk patients. The classification is shown in Table 5 [204]. Furthermore, in Singapore, the treatment algorithm for COVID-19 infection depends on the clinical severity of COVID-19, which is classified into asymptomatic or presymptomatic, mild, moderate, severe and critical stages [204]. The detailed staging of severity is shown in CRP: C-reactive protein; LDH: lactose dehydrogenase; SpO2: oxygen saturation of the blood.
Table 6. Mild (non-severe/critical) patients who do not need supplemental oxygen require only supportive therapy with observation. Severe patients obtain treatment according to the requirement of oxygen with remdesivir alone (or) together with dexamethasone or baricitinib (see Fig. 9).

Table 5: Classification for persons at low versus high risk of disease progression for COVID-19

<table>
<thead>
<tr>
<th>Low risk (fulfilling all criteria below)</th>
<th>High risk (fulfilling any of the criterion below)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age &lt;30 years</td>
<td>Age &gt;30, particularly &gt;50 years</td>
</tr>
<tr>
<td>No chronic comorbidities</td>
<td>Chronic comorbidities (chronic lung, heart or kidney disease, diabetes mellitus, immunosuppression, body mass index &gt;25 if age &lt;60)</td>
</tr>
<tr>
<td>Reassuring clinical features</td>
<td>Worrisome clinical features</td>
</tr>
<tr>
<td>- No dyspnoea</td>
<td>- Dyspnoea</td>
</tr>
<tr>
<td>- Respiratory rate &lt;20 breaths/min</td>
<td>- Respiratory rate &gt;20 breaths/min</td>
</tr>
<tr>
<td>- Normal SpO₂</td>
<td>- Abnormal SpO₂ (&lt;94%)</td>
</tr>
<tr>
<td>- Not requiring oxygen therapy</td>
<td>- Requiring oxygen therapy</td>
</tr>
<tr>
<td>Normal chest X-ray</td>
<td>Chest X-ray shows pneumonia</td>
</tr>
<tr>
<td>Reassuring laboratory results</td>
<td>Worrisome laboratory results</td>
</tr>
<tr>
<td>- CRP &lt;20 mg/L</td>
<td>- CRP &gt;20 mg/L</td>
</tr>
<tr>
<td>- LDH &lt;550 U/L</td>
<td>- LDH &gt;550 U/L</td>
</tr>
<tr>
<td>- Lymphocytes &gt;1 x 10^9/L</td>
<td>- Lymphocytes &lt;1 x 10^9/L</td>
</tr>
<tr>
<td>- Neutrophils &lt;3 x 10^9/L</td>
<td>- Neutrophils &gt;3 x 10^9/L</td>
</tr>
</tbody>
</table>

Source: Updated treatment guidelines for COVID-19, Version 5.0, dated 4 January 2021

CRP: C-reactive protein; LDH: lactose dehydrogenase; SpO₂: oxygen saturation of the blood

Table 6: Clinical staging of the severity of COVID-19

<table>
<thead>
<tr>
<th>COVID-19 severity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asymptomatic or presymptomatic</td>
</tr>
<tr>
<td>Mild</td>
</tr>
<tr>
<td>Moderate</td>
</tr>
<tr>
<td>Severe</td>
</tr>
<tr>
<td>Critical</td>
</tr>
</tbody>
</table>
Earlier on in the pandemic, patients who tested positive were managed as inpatients until their symptoms had resolved and two nasopharyngeal swabs were negative for SARS-CoV-2 on two consecutive days [202]. Since March 2020, to reduce the load on public hospitals, patients with mild symptoms are transferred to CCFs (see page 30) [40]. If patients in these facilities need better management and support, they are transferred to hospitals [143]. If patients remain well on day 14 of the illness and are clinically stable without the need for further medical care, they are transferred to a stepped-down CRF [143]. With effect from 29 May 2020, the MoH revised the discharge criteria to a time-based one where COVID-19 patients assessed to be clinically well by day 21 of the onset of illness could be discharged from isolation without the need for further PCR tests. They are given leave to remain at home for a further 7 days after that [111, 205].
4 Paying for services

4.1 Health financing

While national reserves were drawn on to fund stimulus packages to cushion the economic impact of COVID-19 (see page 52), recurrent expenditure, such as health-care spending, was paid for with recurrent revenues, such as taxes. This is also the government’s plan for health-care spending moving forward [206]. As a pre-emptive measure, the government intends to raise the goods and services tax (GST) to “help fund growing health care and social spending needs, but will carefully monitor the timing of such moves including the state of the economy and spending needs”. The current plan is that GST rate increases will not take effect in 2021 [207].

The Singapore government recognized the importance of increasing accessibility to health-care services and treatment. Early on in the outbreak (on 12 February), the government provided assurance that it would finance treatment costs incurred by patients with COVID-19 in public hospitals [208]. Coverage for COVID-19 inpatient bills was extended from the regular health-care financing channels of government subsidies, MediShield Life\(^8\) and integrated shield plans\(^9\) for qualifying beneficiary groups. Singapore’s insurance associations concurrently issued a joint statement confirming member companies’ provision of coverage for COVID-19-related hospitalization expenses under their policies [31]. After collaboration was established with private sector hospitals on the care of patients with COVID-19, the same government and national insurance coverage for COVID-19 inpatient bills was extended to treatment at private hospitals.

To deter non-compliance with guidelines and reduce further risk of importation from returning travellers, residents and long-term pass holders who disregarded travel advisories would not be subsidized at public hospitals, if admitted as suspected or confirmed cases of COVID-19 within 14 days of return with effect from 27 March 2020 [209]. From June 2020, as Singapore reopened its borders to more international travel, all travellers entering Singapore were required to self-fund their COVID-19 tests and stay at dedicated facilities if necessary [210]. (See Table 8 for more details.)

To support safe distancing measures and the continuation of health-care services for non-COVID conditions, the CHAS\(^10\) (Chronic Subsidy and Medisave) could be tapped into for video consultations of selected chronic illnesses for a limited time from 3 April 2020 (this subsidy is still ongoing). The current scope of coverage includes diabetes, hypertension, bipolar disorder, among other chronic illnesses [38]. The conditions applicable for subsidy and list of approved private health-care institutions providing video consultations for chronic conditions are available at [https://www.moh.gov.sg/covid-19/vc](https://www.moh.gov.sg/covid-19/vc). In addition, the government also introduced special COVID-19 subsidies for the first two years to offset MediShield Life premium increases (70% of the increase in the first year and 30% in the second year). The COVID-19 subsidy applies for Singaporeans, while permanent residents are entitled to them at half the rate provided to Singaporeans [211].

Since the SARS outbreak in 2003, Singapore has instituted a fund for Singaporeans who face loss of income, additional caregiving duties and need for essential items. The Courage Fund was first

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\(^8\) A catastrophic national health insurance, where premiums can be deducted from MediSave accounts

\(^9\) An additional private insurance coverage portion on top of MediShield Life payable from MediSave subject to yearly withdrawal limits

\(^10\) Means-tested portable State subsidies to offset out-of-pocket payment for citizens when they visit private GPs
established in 2003 when Singapore was hit by the SARS outbreak. Fellow Singaporeans donated generously to the Fund to support those who were affected by the outbreak. In this same spirit of uniting the community to support one another through difficult times, Community Chest has been rallying the community to provide relief and support to those affected by the current COVID-19 situation [212].

The Fund’s qualifying criteria for lower-income households affected by COVID-19 include having at least one household member as a citizen or permanent resident, having contracted COVID-19 or being issued SHN/leave of absence (LOA)/QO and having the household income affected by this, and having a gross monthly income of ≤S$ 6200 or gross monthly per capita income of ≤S$ 2000 prior to being affected by COVID-19 [212].

Under the Courage Fund’s COVID-19 relief schemes, grants are disbursed under the Scheme for HCWs who have contracted COVID-19 in the line of duty and Scheme for Frontline Workers and Community Volunteers who have contracted COVID-19 in the line of duty. Dependants of individuals who have succumbed to the virus are also eligible for relief and grants. Families of HCWs will receive a larger amount of S$ 30 000 and an education grant if eligible, which covers education and living expenses. For non-HCWs, the amount ranges from S$ 10 000 to S$ 20 000 [212].

Under the FSS (see page 30), PHPCs charge flat subsidized rates for patients diagnosed with ARI and the MoH reimburses these PHPCs at flat rates (see Table 7). Foreigners are not eligible for the FSS.

Table 7: PHPC patient charges and reimbursement under the FSS

<table>
<thead>
<tr>
<th>Beneficiaries</th>
<th>Patient charge (not inclusive of GST)</th>
<th>Reimbursement by the MoH (flat rate per visit)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public Assistance (PA) cardholders</td>
<td>$0</td>
<td>$60</td>
</tr>
<tr>
<td>Pioneer Generation (PG)(^{11})/Merdeka Generation (MG) cardholders(^{12})</td>
<td>$5</td>
<td>$55</td>
</tr>
<tr>
<td>Non-Pioneer Generation/non-Merdeka Generation Singapore citizens and permanent residents</td>
<td>$10</td>
<td>$50</td>
</tr>
</tbody>
</table>

To expedite the claims process, PHPCs can make FSS claims by logging into the MoH Healthcare Claims Portal (MHCP) and submit the claim.

Funding was also extended to PHPCs to support their efforts at surveillance and triaging of patients during the pandemic. The Health Minister had shared that the MoH would offer a one-off COVID-19

\(^{11}\) Introduced in 2014 for citizens born before 1950. This group receives additional subsidies for some outpatient services at polyclinics and public hospitals, at GP clinics under the Community Health Assist Scheme (CHAS), and also receives some other additional healthcare-related payouts [272].

\(^{12}\) Introduced in June 2019 for citizens born between 1950 and 1959. It is similar to the Pioneer Generation Package but has more limited benefits in the form of additional outpatient care subsidies and other additional health-care-related payouts [273, 274].
grant of $10 000 for all PHPCs to mitigate any additional costs they may be facing. Funding was also set aside to support collaborations with the private sector to expand testing capacity and accessibility. The MoH has been providing a one-time SASH start-up grant of $1200 to PHPCs under the SASH programme to “help these clinics cover the additional startup costs” [213].

Reimbursements to private hospitals for COVID-19 treatment and isolation wards were provided through the same funding channels of government subsidies, MediShield Life and integrated plans as per that for public hospitals.

Funding for all COVID-19-related health care for migrant workers admitted to hospitals, FAST and dedicated medical centres for migrant workers’ dormitories and their testing efforts have been provided by the government. The government is in the process of passing the financial costs of RRT to employers.

4.2 Entitlement and coverage

The government provided assurance early on in the pandemic (from early February) that it would cover expenses related to testing and treatment for COVID-19 for eligible suspect cases. Coverage was initially limited to services at public hospitals, with the centralized testing, management and isolation of cases at the NCID and public hospitals. Coverage for other COVID-19-related services (e.g. SHN facilities, testing, etc.) was later extended to specified groups of people, in line with their extended capacity and availability. Entitlement and exclusions were adjusted over the course of the pandemic in response to outbreak developments and to complement changes in containment measures. Coverage for complementing services supporting existing containment/surveillance measures, such as subsidies for ARI consultations and video consultations, has been concurrently instituted.

Table 8: Timeline on entitlement to COVID-19-related care services

<table>
<thead>
<tr>
<th>Period</th>
<th>COVID-19-related care</th>
<th>Eligible groups</th>
<th>Exclusions</th>
</tr>
</thead>
<tbody>
<tr>
<td>From February 2020</td>
<td>Subsidized treatment, investigations and medications to patients with respiratory symptoms at public health preparedness clinics (PHPCs)</td>
<td>Citizens and permanent residents (PRs) [32]</td>
<td>Others. Consultations at non-PHPC clinics</td>
</tr>
<tr>
<td>From February 2020</td>
<td>COVID-19-related hospital bills in public hospitals, including COVID-19 tests</td>
<td>All patients suspected of being infected and who must be admitted to hospitals for isolation and management to prevent community transmission</td>
<td>Outpatient treatment at GP clinics or polyclinics, and treatment at private medical facilities (all confirmed COVID-19 cases were treated at public hospitals during this period.) [30, 214]</td>
</tr>
<tr>
<td>Period</td>
<td>COVID-19-related care</td>
<td>Eligible groups</td>
<td>Exclusions</td>
</tr>
<tr>
<td>---------------------</td>
<td>--------------------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>From 7 March 2020</td>
<td>COVID-19-related hospital bills in public hospitals, including COVID-19 tests</td>
<td>Only Singapore citizens, permanent residents (PRs) and long-term pass holders are eligible for the COVID-19-related bill coverage</td>
<td>All other inbound foreigners will have to pay unsubsidized rates for inpatient stay at public hospitals, bearing the full cost. This includes tests for COVID-19, stay home notice (SHN) at a dedicated facility and medical expenses should they be infected with COVID-19 [214]. Fees incurred in private hospitals are not covered by any COVID-19-related bill coverage.</td>
</tr>
<tr>
<td>From 24 March 2020</td>
<td>Subsidized hospital and testing rates for returning travellers</td>
<td>Singaporeans, PRs and long-term pass holders who departed from Singapore before 27 March 2020</td>
<td>Those who departed after 27 March 2020 will be charged unsubsidized rates at public hospitals if they are admitted as suspected COVID-19 patients within 14 days of returning. These people will also not be able to claim from their MediShield Life or Integrated Shield Plans for these treatments at both public and private hospitals [215].</td>
</tr>
<tr>
<td>From 3 April 2020</td>
<td>Tapping on the Community Health Assist Scheme (CHAS) Chronic Subsidy and MediSave for video consultations of consultations for selected chronic illnesses [38]</td>
<td>All CHAS Chronic Subsidy- and MediSave-qualifying beneficiaries</td>
<td>Others</td>
</tr>
<tr>
<td>From April 2020</td>
<td>COVID-19 PCR tests</td>
<td>For all people in Singapore, as long as they are referred by a registered doctor under current surveillance and patient triage protocols</td>
<td>Others who need the test and are eligible for it, e.g. travellers</td>
</tr>
<tr>
<td>Period</td>
<td>COVID-19-related care</td>
<td>Eligible groups</td>
<td>Exclusions</td>
</tr>
<tr>
<td>---------------------</td>
<td>----------------------------------------------------------------------------------------</td>
<td>------------------------------------------</td>
<td>------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td></td>
<td>Government-ordered targeted testing for specified/higher-risk groups (e.g. migrant workers, nursing home staff, etc.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>From April 2020</td>
<td>CHAS subsidies and use of MediSave for regular follow ups on chronic conditions through video consultation. Qualifying chronic conditions are listed at: <a href="https://www.moh.gov.sg/covid-19/vc">https://www.moh.gov.sg/covid-19/vc</a></td>
<td>All eligible CHAS and MediSave users</td>
<td>Others</td>
</tr>
<tr>
<td>From 17 June 2020</td>
<td>Cost of SHN facilities</td>
<td>Singaporean citizens and PRs</td>
<td>All incoming travellers who are not Singapore citizens or PRs will have to pay for their stay at dedicated SHN facilities.</td>
</tr>
<tr>
<td>From 7 August 2020</td>
<td>Tap on regular health-care financing, such as government subsidies, MediShield Life and integrated shield plans, for inpatient medical bills.</td>
<td>Singaporeans, PRs and long-term pass holders who are travelling abroad under permitted travel arrangements, such as bilateral travel arrangements with Malaysia and China. Should they have COVID-19 symptoms within 14 days of their return, they are eligible to tap on such regular health-care financing [216].</td>
<td>Those who travel abroad without being under permitted travel arrangements will not be able to tap on these regular health-care financing arrangements [216].</td>
</tr>
<tr>
<td>From December 2020</td>
<td>COVID-19 PCR tests [218] For all people in Singapore, as long as they are referred by a registered doctor under current</td>
<td>All others who would like to take the test (they can</td>
<td></td>
</tr>
<tr>
<td>Period</td>
<td>COVID-19-related care</td>
<td>Eligible groups</td>
<td>Exclusions</td>
</tr>
<tr>
<td>--------</td>
<td>----------------------</td>
<td>-----------------</td>
<td>------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td>surveillance and patient triage protocols Government-ordered targeted testing for specified/higher-risk groups (e.g. rostered routine testing [RRT] for migrant workers, etc.)</td>
<td>order for the test at their own cost ) [218]</td>
</tr>
</tbody>
</table>
5 Governance

5.1 Pandemic response planning

Planning and leadership

The 2003 SARS experience gave rise to a culture and practice of readiness for future outbreaks in the pre-COVID-19 years. After the SARS experience, the government developed a disease outbreak response plan with response levels correlating with the WHO Pandemic Alert Response system [219]. The colour-coded “Disease Outbreak Response System Condition” (DORSCON) levels incorporated progressive degrees of border controls, community-based measures, infection control in hospitals, and other containment/mitigation measures (see Fig. 10). The response plan was intended to raise awareness nationwide, and facilitate a cross-sector coordinated response to varying stages of spread of infectious diseases [2]. On 7 February 2020, with the discovery of several cases of COVID-19 with no links to previous cases or travel history to China, Singapore raised the DORSCON level to orange [182].

Fig. 10: DORSCON alert levels

<table>
<thead>
<tr>
<th>Nature of disease</th>
<th>Green</th>
<th>Yellow</th>
<th>Orange</th>
<th>Red</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disease is mild OR Disease is severe but does not spread easily from person to person (e.g. MERS or H7N9)</td>
<td>Disease is severe and spreads easily from person to person but is occurring outside Singapore OR Disease is spreading in Singapore but is: a) typically mild i.e. only slightly more severe than seasonal influenza. Could be severe in vulnerable groups (e.g. H1N1 pandemic) OR b) being contained</td>
<td>Disease is severe AND spreads easily from person to person, but disease has not spread widely in Singapore and is being contained (e.g. SARS experience in Singapore)</td>
<td>Disease is severe AND is spreading widely</td>
<td></td>
</tr>
<tr>
<td>Impact on daily life</td>
<td>Minimal disruption, e.g. border screening, travel advice</td>
<td>Minimal disruption e.g. additional measures at border and/or healthcare settings expected. Higher work and school absenteeism likely</td>
<td>Moderate disruption e.g. quarantine, temperature screening. Visitor restrictions at hospitals</td>
<td>Major disruption e.g. school closures, work from home orders, significant number of deaths</td>
</tr>
<tr>
<td>Advice to public</td>
<td>• Be socially responsible: If you are sick, stay at home • Maintain good personal hygiene • Lookout for health advisories</td>
<td>• Be socially responsible: If you are sick, stay at home • Maintain good personal hygiene • Lookout for health advisories</td>
<td>• Be socially responsible: If you are sick, stay at home • Maintain good personal hygiene • Lookout for health advisories • Comply with control measures</td>
<td>• Be socially responsible: If you are sick, stay at home • Maintain good personal hygiene • Lookout for health advisories • Comply with control measures • Practise social distancing: avoid crowded areas</td>
</tr>
</tbody>
</table>

Source: Ministry of Health and www.gov.sg

H1N1: a type of influenza virus; H7N9: a type of avian influenza virus; MERS: Middle East respiratory syndrome; SARS: severe acute respiratory syndrome
As a small-sized island nation, Singapore did not face the added complexity of coordination of policy implementation across states or provinces. However, learning from the SARS experience that an outbreak response necessitated a coordinated response across sectors, the government set up the Multi-Ministry Taskforce on 22 January 2020 to oversee the national response to COVID-19. It comprises ministerial rank members from across the ministries of health, trade, national development, education, communications and information, manpower, environment and water resources, social and family welfare, and transport [2, 220]. This facilitated swifter and more tightly coordinated multisectoral responses to the evolving pandemic situation.

The ministries comprising the Multi-Ministry Taskforce work together to coordinate surveillance, communications, international reporting and testing. When the outbreak in foreign worker dormitories necessitated a more dedicated strategy and effort, an interagency task force was set up to facilitate closer cooperation between the ministries of health and manpower (sectors directly related to the crisis), as well as involve more deeply relevant expertise from the Singapore Armed Forces and civil defence. The interagency task force is co-led by the Chief Guards Officer from the Army and the Senior Minister and Coordinating Minister for National Security [76, 221].

**Legislation**

Singapore has not invoked emergency laws to deal with the COVID-19 outbreak. In the earlier months of the pandemic, it relied on powers provided under the Infectious Diseases Act (already strengthened during the global SARS outbreak in 2003) and border control powers under the Immigration Act. When this was no longer adequate, the new COVID-19 (Temporary Measures) Act 2020 (CTMA) was passed and came into effect on 7 April 2020. The CTMA grants the executive greater powers to issue control orders when transmission of COVID-19 in the community constitutes a serious threat to public health and a control order is required to existing written laws [56, 222].

Compliance with safe distancing measures in health-care institutions (e.g. the limitation of cross-institution movement of HCWs), and the deferment of non-essential services for all health-care institutions and practitioners were incorporated under the CTMA. Guidance on the type of services that are regarded as essential and non-essential was provided by the MoH on 6 April, and the MoH expressed that, where possible, services that were suitable for teleconsultation should be delivered remotely [56, 182, 223]. Accompanying reimbursements for qualifying remote consultations came into effect (see page 39).

**Other coordinating/supporting bodies**

In planning the response, the government also harnessed the academia and research institutes. Epidemiological models were co-created at the Saw Swee Hock School of Public Health, National University of Singapore, with the MoH, to project disease spread and simulate the reduction in cases and infection rate under different intervention scenarios. Interventions modelled included community approaches (quarantine, school/workplace distancing, stand-alone or combined approaches, etc.) [224, 225], home-based versus institutional isolation policies [226] and border quarantine-test protocols (combinations of pre-departure and post-arrival testing with varying quarantine periods for travellers) [227, 228]. Geospatial network analysis of the COVID-19 outbreak in the foreign worker population was also conducted to understand frequently visited community locations anchoring worker mobility networks, which facilitated cross-dormitory spread of COVID-19 across the country [229].
The large amount of academic literature emerging on COVID-19 also meant that it was challenging for the government to digest relevant information that could inform policy-making. The School conducted rapid and weekly evidence synthesis on the key topics of vaccines, diagnostics, therapeutics, clinical characteristics, containment measures and national responses/exit plans adopted by other countries to support the government [230].

On diagnostics and surveillance, the Agency for Science, Technology and Research (A*STAR) and Tan Tock Seng Hospital have developed a test kit (the Fortitude Kit) that can detect the presence of the SARS-CoV-2 quickly and with high accuracy [231, 232]. The test kit has received Singapore HSA’s provisional authorization for clinical use, and has been implemented in 13 Singapore hospitals and laboratories, public and private. A rapid point-of-care test, which could potentially expand the availability of testing in locations such as immigration checkpoints, is in the pipeline [232]. The use of new serological testing from the Duke-NUS Medical School also helped uncover missing links between clusters in contact-tracing operations [233]. Such collaborative efforts with universities and research institutes facilitated the availability of scientific and evidence-guided information for the government’s response planning.

5.2 Private sector involvement and medical devices/aids

Involvement and regulation

Collaboration with the private sector was an important component in the workforce and capacity planning that supported surveillance and accessibility of health-care services during the pandemic (see sections on “Testing”, “Physical infrastructure” and “Providing health services effectively”). Regulation and control of private sector operations was achieved through centralized licensing, registration and regular policy guidance/advisories on components of the national COVID-19 response to the respective subsector players of the health-care system involved. This included preregistration and preparation of the PHPC network during pre-COVID times, regular advisories issued by the MoH and MSF to all licensed practitioners and long-term care providers, required training and adherence to the National Telemedicine Guidelines by all doctors practising telemedicine, MoH-approved licensing of all test kits and PCR and ART test providers, and the provision of regularly updated COVID-19 treatment guidelines by the NCID. Where relevant, these regulatory levers were further supported with reimbursement mechanisms, such as reimbursements to PHPCs under the FSS for subsidized ARI consultations and to clinics for MediSave-claimable video consultations.

Medical devices/aids

The urgent need for medical devices, aids and treatment during the pandemic prompted local research and manufacturing efforts to develop more cost-effective and scalable testing/treatment equipment, importers’ licence waivers for medical devices/aids, and faster track or provisional approval for COVID-19-related treatment or devices (e.g. remdesivir and locally developed devices such as ART test kits and the Fortitude Kit (see pages 49). Other examples include the potential invention of a faster breathalyser test for diagnosing COVID-19 that a local company is currently working on [234], and approval from the HSA in July 2020 for another local medical device company’s Alpha ventilator, which is the world’s first telehealth ventilator ideally suited for treating patients with COVID-19 and other infectious diseases [235].
5.3 Vaccination policy

With vaccination being one of the key strategies to reduce the number of people susceptible to the disease and chances of transmission, and to enable further exiting from the Circuit Breaker, a Therapeutics and Vaccines Expert Panel was formed in April 2020. It comprised 18 scientists and clinicians to advise the government on therapeutics and vaccines, and assessed the suitability of vaccine candidates for the population, taking into consideration safety, efficacy, vaccine tolerability and data adequacy of clinical trials. All vaccines must also be authorized by the HSA before being deployed [236]. In evaluating vaccine options, given the lack of certainty regarding the success of the vaccines, due consideration was given to diversifying choices across different vaccine technology platforms. There was also the need to find a balance between established options and those fastest on the market [237].

Singapore purchased the first vaccine, Moderna (mRNA vaccine), in June 2020, and two more vaccines, Sinovac (inactivated vaccine technology) and Pfizer-BioNTech (mRNA vaccine), in August 2020, under Advance Purchase Agreements [237]. On 14 December 2020, the HSA granted authorization of the Pfizer-BioNTech COVID-19 vaccine via the Pandemic Special Access Route (PSAR) for active immunization to prevent COVID-19 disease in Singapore [238, 239]. At the time of writing this publication, Moderna vaccine is undergoing review prior to granting of authorization to use.

An expert committee was convened by the MoH in October 2020 to make recommendations to the government on Singapore’s COVID-19 vaccination strategy, including ensuring the safe and effective use of COVID-19 vaccines in Singapore’s population groups [238]. The Expert Committee submitted detailed recommendations specific to the use of the Pfizer-BioNTech COVID-19 vaccines to the government on 24 December 2020 [238], which were accepted by the government. It announced on 27 December its national plans to vaccinate all Singaporean and long-term residents by end-2021 [238]. More than S$ 1 billion has been set aside under the national vaccine strategy so that all Singaporeans and long-term residents will be able to be vaccinated for free by end-2021 [236, 240]. Vaccination is voluntary but strongly encouraged by the government for all who are medically eligible to be vaccinated. From 30 December 2020, the MoH began vaccinating HCWs and staff in health-care institutions [238]. Vaccination for the elderly aged 70 years and above will start in February 2021, followed by vaccination for other medically eligible Singaporeans and long-term residents [238].

Seniors who are 70 years old or above will receive personalized letters inviting them to sign up for vaccination, and those who sign up will be vaccinated at a polyclinic or vaccination centre near their home. Plans are under way to set up vaccination centres in each town by mid-March [241]. The sign-up process will include reading through an information sheet that provides information on the vaccine, and who should or should not get vaccinated, followed by completion of a form which screens for conditions that make vaccination inadvisable. The screening process is repeated (going through the screening process with a medical staff/health-care assistant) at the vaccination site prior to vaccination [242, 243]. An MoH circular providing information on the indications and contraindications to COVID-19 vaccination, frequently asked questions (FAQs) and recommendations for persons to be vaccinated with the Pfizer-BioNTech COVID-19 vaccine has been circulated to all medical practitioners, specialists and general medical clinics to guide and align their management of consultations to the national policy. The current national vaccine policy does not
recommend vaccination for pregnant women, severely immunocompromised persons, persons with bleeding risk and persons who have ever had severe allergies. Recommended criteria (e.g. low platelet levels) defining such groups are provided in the screening process and in the MoH circular to medical professionals/clinics [244].

Prior to the vaccine roll-out, panel discussions and webinars held with MoH personnel and relevant experts on the vaccine’s safety and efficacy were made accessible to the public to build public confidence in the vaccine. Information on Singapore’s COVID-19 vaccination programme is also available at https://www.moh.gov.sg/covid-19/vaccination. The Prime Minister and his Cabinet colleagues were among the first to receive their COVID-19 vaccination early in a vote of confidence for the Pfizer-BioNTech vaccine and approval from experts in Singapore [245].

The Economic Development Board (EDB) is also investing about US$ 45 million (S$ 61 million) into the manufacture of a vaccine by Arcturus Therapeutics co-developed with local researchers [231]. The EDB will have the option and right to purchase up to US$ 175 million (S$ 236 million) worth of the vaccine at prenegotiated prices, with shipments expected to begin in the first quarter of 2021 [231]. There are also ongoing efforts to establish vaccine production facilities in Singapore. Thermo Fisher Scientific, one of the world’s largest life sciences company, recently announced that it would establish a new US$ 130 million facility in Singapore in 2022 [237]. Several other companies are also in the final stages of talks to invest in new vaccine production plants in Singapore [237].
6 Measures in other sectors

Border controls

As early as 2 January 2020, temperature screening and issuance of health advisory notices were instituted for travellers on inbound flights from Wuhan. This was later extended to inbound flights from China, land and sea checkpoints, and all flights into Singapore. Travel advisories issued to Singaporeans to avoid travelling to specific countries and denial of entry/transit of travellers from these countries were later instituted and progressively adjusted as the epidemic situation in China evolved, and the source epidemic extended to autochthonous infections outside of Wuhan and China [145, 246]. On 23 March, entry denial was extended to travellers from all countries, while returning travellers from specified regions were issued SHNs. (See Fig. 11 for timeline of border measures instituted up until Singapore’s closure of borders.)

From June, Singapore progressively resumed some degree of restricted air travel and established Reciprocal Green Lane (RGL) arrangements with select countries. These are limited to business and essential travel and subject to quarantine-test protocols, mostly involving 14-day SHN, and/or with restricted itinerary. Travellers are also required to use the TraceTogether app during their stay. The first RGL started on 8 June with China, and gradually extended to some other countries. By October, Singapore had RGL arrangements with a total of seven countries (Brunei, China [six provinces], Germany, Indonesia, Japan, Malaysia, Republic of Korea) and by December, had unilaterally opened its borders to travellers from Viet Nam, Brunei, New Zealand and Australia (excluding Victoria state) and Taiwan, China. The risk of importation from the latter group of countries/regions, where the virus was well under control, was comparatively lower. Unlike RGLs, all forms of short-term travel, including for leisure, are permitted between Singapore and these countries. Travellers will also not be required to serve SHNs but will need to take a swab test upon arrival and can go about their activities with the use of TraceTogether after they receive a negative test result [247-249]. In addition, Singapore and Hong Kong reached an in-principle agreement to establish a bilateral air travel bubble on 22 November, where those travelling under the bubble will have no restrictions on their travel purpose and will not need to have a controlled itinerary. Due to a spike in COVID-19 cases in Hong Kong in November, the air bubble arrangement has been deferred [250, 251]. On 26 December, RGLs with Indonesia and Japan have also been temporarily suspended as both countries announced a temporary ban on the entry of foreign nationals into their countries [252].

As of February 2021, RGLs with the rest of the countries and unilateral opening of borders to travellers from Viet Nam, Brunei, New Zealand, Australia (excluding Victoria state) and Taiwan, China remain unchanged [252, 253]. However, due to epidemiology of the disease in different countries, state of RGLs are subject to change and latest updates on Singapore’s official travel advice for external travellers and residents can be found at https://safetravel.ica.gov.sg/arriving/overview and https://www.mfa.gov.sg/Services/Singapore-Citizens/COVID-19-Travel-Restrictions.
Fig. 11: Timeline of border measures (January to April 2020) [2]
Economy

Fiscal measures were introduced to alleviate the impact on businesses and citizens’ livelihoods. A total of almost $100 billion amounting to 20% of the country’s gross domestic product (GDP) was delivered from February to May in the form of four stimulus packages to cushion the impact of the pandemic and Circuit Breaker on the economy and employment [254, 255]. These included co-payment of portions of local workers’ wages and wage increases, corporate income and property tax rebates, and cashflow-assisting measures, which extended in magnitude and duration as the outbreak situation evolved and its economic impact deepened. There has also been increased focus on generating new jobs, entrepreneurship and training opportunities in the packages over the course of the months (see Table 9). These measures are estimated to have substantially cushioned the economic impact. The Monetary Authority of Singapore has estimated that the combined budgets will prevent the economy from contracting by a further 5.6% of GDP in 2020, and 4.8% in 2021, and offset some of the rise in resident unemployment rate by about 1.7 percentage points in 2020 [206].

Shortly after the announcement of the first set of fiscal measures, the president and ministers took a three-month pay cut and senior management of several government-owned and government-linked companies announced pay cuts as well [217, 256-258].

The government drew on national reserves to fund a large part of these budgets, an extraordinary move that had happened only once prior in Singapore’s history – during the 2008–2009 global financial crisis. To date (since June 2020), the government had drawn on S$ 52 billion from the past reserves [259].

Table 9: Fiscal measures introduced to alleviate the impact of COVID-19 on the economy

<table>
<thead>
<tr>
<th>Date</th>
<th>Fiscal measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>18 February 2020</td>
<td>A $4 billion stabilization and support package, which copays portions of local workers’ wages and wage increases, grants corporate income and property tax rebates, and provides additional cashflow-assisting measures for the more badly hit sectors of tourism, aviation, retail, food and beverage, and point-to-point transport services [260, 261].</td>
</tr>
<tr>
<td>(announced)</td>
<td></td>
</tr>
<tr>
<td>26 March</td>
<td>The Resilience Budget worth $48.4 billion introduced to further alleviate the deepening impact on businesses. Earlier fiscal measures were enhanced with higher co-funding of local employees’ monthly wages (up to 75% for 9 months subject to a salary cap for the hardest hit sectors) and wage increases, extended corporate tax treatments (rebate of 25% of tax payable), enhanced financing schemes for Singapore-based enterprises (increased maximum loan quantum and increased government’s risk-share to 80%), and additional rebates for the aviation, land transport and aviation sectors. The budget also sought to create new jobs (10,000) and training (8000) opportunities [260, 261].</td>
</tr>
<tr>
<td>6 April (announced)</td>
<td>The Solidarity Budget (worth $5.1 billion) extended the 75% co-funding of wages to every local employee for one month, increased government risk-share of financing loans to businesses to 90%, rental waiver for one month, non-residential property tax rebates (up to 100%), waiver of foreign worker levy due in April and issued cash pay-outs to Singaporeans [262]. The COVID-19</td>
</tr>
</tbody>
</table>
### Fiscal measures

**Date**
- 26 May (announced)

**Fiscal measures**
- (Temporary Measures) Bill ensures pass-through of property tax rebates from property to tenants [263].
- The Fortitude Budget (worth $33 billion) extended co-funding of wages to local employees by another month or up until when the firm concerned can reopen, extended levy waivers and rebates, provided $2 billion in cash grants to support businesses with rental costs, rental waivers for tenants of government properties. It also creates and supports close to 100,000 jobs, traineeships and training opportunities. In addition, financial support in terms of matching private investments and pay-outs was extended to encourage entrepreneurship activities and efforts to digitalize food services/retail sectors [264].

### Cross-border collaboration and movement of goods

Since the start of the pandemic, the Ministry of Trade and Industry (MTI) issued three announcements on commitments with other countries to secure supply chains and facilitate cross-border movement amid the COVID-19 pandemic. The countries included the Asia-Pacific Economic Cooperation (APEC) nations, Lao People’s Democratic Republic, Myanmar, Nauru, the United Arab Emirates (UAE), Uruguay and the United Kingdom (UK) [265-267]. Commitments include ensuring that trade lines remain open to facilitate the flow of goods, and refrainment of export controls/tariffs/non-tariff barriers. Commitments with some countries include agreement to facilitate the resumption of essential cross-border travel while balancing public health considerations, investment protection, and development of digital trade and business.

During the Malaysian border lockdown, the government worked with companies and provided subsidies on the arrangement of accommodation to Malaysian workers who used to commute daily by land to and from Johor to Singapore. An in-principle agreement was worked out with Malaysia on the continuation of smooth transport of necessities such as food across both countries’ land checkpoints. These helped to prevent disruption to essential services and supplies in Singapore while safeguarding the livelihoods of Malaysian workers [268, 269].

To manage and anticipate any disruption to supply lines for essential goods, the MTI integrated public and private sector trade data, such as bill of lading data, on a central platform. This enhanced surveillance capability and enabled a sharper strategic response in the event of supply chain disruptions [270].

To bolster Singapore’s resilience to potential supply chain disruptions and resource constraints, there has been increased focus on producing essential supplies locally. These can support both local consumption and export needs. Such supplies include medical supplies (see page 26) and food. Singapore has set a goal of producing 30% of nutritional needs locally by 2030, up from less than 10% just prior to the onset of COVID-19, to strengthen the resilience of the agri-food sector to food supply disruptions [151].

As an increasing share of global trade takes place digitally, Singapore has also formalized digital trade rules and collaborations with different countries through digital economy agreements. For example, the Singapore–Australia Digital Economy Agreement facilitates cross-border transfer of data from data storage centres by businesses. This also enables cross-compatible e-payment frameworks [270, 271].
**7 Update as of July 2021**

**7.1 Situation overview**

The Singapore government continues to monitor the local and global COVID-19 situation closely and has been taking swift pre-emptive and proactive measures in response to the constantly evolving situation. Singapore has adopted the approach of focusing on the health and wellbeing of citizens, while cautiously re-opening the economy. Since the start of 2021, the COVID-19 situation in Singapore has been most notably characterized by the emergence of variant strains from other countries and the rollout of a robust national vaccination program.

The DORSCON level continues to remain at orange and will do so until the global situation improves [275]. As of 25 July 2021, Singapore had a total of 64,142 COVID-19 cases; of which, 1,537 were active cases and 62,605 cases were discharged [276]. Of the 1,537 active cases, 522 patients were stable in hospitals, 1,013 patients were in community care facilities (houses patients who are clinically well but still test positive for COVID-19), and 2 patients were in critical conditions in the ICU. Singapore has reported 37 deaths related to COVID-19 complications in total, and currently has the lowest case fatality rate in the world at 0.06% [277].

Since the start of 2021, cases among migrant workers and dormitory residents have been negligible, while the majority of cases in Singapore have been imported and placed on quarantine. The COVID-19 condition stabilized in early 2021 and for a while, there was no new local transmission; however, community cases started to rise in April potentially due to the introduction of COVID-19 variants from other countries [278]. Tackling unlinked and asymptomatic cases in the community has been an additional challenge recently. See Fig. 12.

*Fig. 32: Epidemic curve of COVID-19 outbreak by press release date (Data updated as of 19 July 2021)*

7.2 Policy and decision making

At the outset of the pandemic, the government set up a Multi-Ministry Taskforce to oversee the national response to COVID-19. On 23 April 2021, the Prime Minister announced that reshuffling of the cabinet would take effect from 15 May 2021 so that cabinet members could gain new experience and exposure by handling different portfolios [279]. Most notably, Minister Ong Ye Kung moved from the Transport Ministry to take over as Minister for Health. Minister Gan Kim Yong, who had been the Health Minister for almost a decade, moved to the Ministry of Trade and Industry. Minister Lawrence Wong shifted from the Ministry of Education to the Minister for Finance. Minister Ong joined Minister Gan and Minister Lawrence as co-chair of the Multi-Ministry Taskforce, and they have collaboratively defined the government’s pandemic response since then.

After approximately 18 months of tackling the pandemic, the Singapore government is now developing its transitional roadmap to the post COVID-19 era. On one hand, there is an inherent desire to re-open borders and the economy. The island-nation thrives on trade and cannot afford to remain closed for long like more domestic-focused economies. In addition, Singapore is recognized as an attractive tourist and business hub but risks eroding its competitiveness as other economies, such as Hong Kong SAR and the US, start to open sooner. However, on the other hand, the government is concerned that any relaxation of rules will compromise the hard-won success against the virus. The emergence of variant strains, such as the delta strain, and the close proximity to and frequent business done with India and other ASEAN countries, which have or are experiencing record-breaking upsurges in COVID-19 cases, are factors of concern. Re-opening prematurely could lead to another wave, further pressure on healthcare systems, and waning confidence in the ruling political party. Therefore, Singapore is in a stalemate situation where re-opening the economy is an existential dilemma [280]. On the ground, individuals and businesses are getting fatigued with the unpredictably changing regulations and demand more clarity on the future.

In response to these sentiments, the Prime Minister delivered a national address on 31 May 2021 followed by a ministerial commentary from the 3 co-chairs of the Multi-Ministry Taskforce on 24 June 2021 which collectively laid out a broad plan for Singapore’s COVID-19 roadmap [281, 282]. The government intends to transit into a “new normal” where COVID-19 will shift from being pandemic to endemic. Endemic COVID-19 means the pandemic will transform into something less threatening, such as influenza, chickenpox, or dengue, which means borders can progressively open but small outbreaks of the disease will occur from time to time. In this “new normal”, Singaporeans will need to adapt to live with the virus which will be kept under control through testing, contact tracing and vaccinating but the battle may continue to be fraught with uncertainty as the virus mutates. The majority will recover if infected and can carry on with daily activities as long as they take general hygienic precautions but a minority may become severely ill. Singapore’s priority is to get through this pandemic and position itself strongly for the future, even as the virus continues to evolve.

The “new normal” will be enabled by three key initiatives: more and faster **vaccinating, testing and contact tracing**. Endemic COVID-19 is envisioned to include:

- Allowing infected people to recover at home without the need to be admitted to community care facilities or hospitals, as done with the common cold
• Transitioning from massive contact tracing and quarantining of people to instead allowing people to test regularly and self-isolate as needed

• Shifting focus away from measuring daily case totals to the number of people that are very sick or in the ICU, like Singapore’s flu monitoring system

• Progressively easing safe management rules (including resuming major events) and increasing certainty for businesses

• Resuming travel to countries that have controlled the virus and turned it into an endemic norm

7.3 Re-opening in phases

Singapore’s eventual goal is to live in a world where COVID-19 is endemic. Currently, the country is still transitioning from pandemic to endemic COVID-19 and as a result, the physical distancing measures put in place in the last few months are a reflection of this progressive shift. The unpredictable COVID-19 situation locally has prompted government policies and responses that constantly adapt, giving rise to re-opening the country in phases (see Table 10). After the island wide Circuit Breaker lockdown in April 2020, the Multi-Ministry Taskforce implemented a three-phased approach to resume activities safely [283]. Phase 1 started on 2 June 2020, Phase 2 started on 19 June 2020, and Phase 3 lasted from 28 December 2020 to 7 May 2021. However, the country reverted to Phase 2 (heightened alert) between 8 May and 13 June 2021 due to the spike in community cases in April. This was followed by Phase 3 (heightened alert) which is expected to last until the end of 2021 as Singapore gets closer to its goal of a “new normal”. The defence capabilities built over the past year in terms of testing, contact tracing and vaccinating have enabled Singapore to re-open in phases without the need for another Circuit Breaker [284].

Table 10: Timeline of physical distancing measures

<table>
<thead>
<tr>
<th>Date</th>
<th>Rationale</th>
<th>Physical distancing measures</th>
</tr>
</thead>
</table>
| From 8 May 2021 | • Phase 2 (heightened alert) implemented due to increase in community cases and outbreak of clusters emerging after long periods of very few cases, potentially driven by variants of the virus  
• Prime Minister emphasized that Singapore should not “celebrate too early, relax too fast, let the guard down and cause another wave to come” [285] | **Social gatherings** – Allowed to comprise up to 5 people. Households could also receive up to 5 visitors per day.  
**Workplace, museums, public libraries** – Operating capacity reduced to 50%.  
**Gyms and fitness studios** – Indoor studios closed as they are virus transmission hotspots. Outdoor classes capped at 30 people.  
**Congregational services, funerals, cinemas, marriage solemnizations, wedding receptions, live performances** – Operating capacity reduced and pre-event testing (PET) made mandatory. [286, 287] |
<table>
<thead>
<tr>
<th>Date Range</th>
<th>Events</th>
<th>Social gatherings</th>
<th>Food &amp; Beverages</th>
<th>Personalized services</th>
<th>Malls, public libraries, museums, attractions</th>
<th>TraceTogether-only SafeEntry</th>
<th>Malls, public libraries, museums, attractions</th>
<th>Education</th>
</tr>
</thead>
<tbody>
<tr>
<td>16 May 2021 – 13 June 2021</td>
<td>Phase 2 (heightened alert) extended with tighter measures due to growing clusters at Changi Airport, Tan Tock Seng Hospital, and several institutes of education [288]</td>
<td>Reduced to 2 people.</td>
<td>Dining at restaurants prohibited given that being in closed environments within close proximity to others without masks made it a risky activity.</td>
<td>Services that required masks to be removed, such as facials, halted.</td>
<td>Operating capacity reduced to 25%.</td>
<td>Combined use of these tools reduced time of contact tracing from 4 to less than 1.5 days. Use of these tools progressively made mandatory for all Singaporeans to enter venues [289].</td>
<td>Operating capacity reduced to 25%.</td>
<td>Full home-based learning at schools and tuition centres. Lectures capped at 50 students in universities. [290, 291]</td>
</tr>
<tr>
<td>From 14 June 2021</td>
<td>Phase 3 (heightened alert) Stage 1 implemented following a decline in community cases</td>
<td>Increased to groups of 5 people.</td>
<td></td>
<td></td>
<td>Operating capacity increased to 50% with PET [290].</td>
<td></td>
<td></td>
<td>In-person tuition and enrichment classes resumed with enhanced safe management measures. [292]</td>
</tr>
<tr>
<td>From 21 June 2021</td>
<td>Phase 3 (heightened alert) Stage 2 implemented</td>
<td>Mask-off activities – Dining at restaurants and indoor mask-off sports allowed to resume in group sizes of up to 2 people, instead of up to 5 as previously announced.</td>
<td>Testing – Fast and easy testing (FET) capacity ramped up for routine testing of staff in higher-risk activities.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Wedding receptions – Prohibited till further notice. [293, 294]</td>
</tr>
</tbody>
</table>
7.4 Vaccination

Singapore has a robust vaccination policy in place, with the aim to provide vaccines to all Singaporeans and long-term residents by the end of 2021. As of 18 July 2021, 2,747,489 residents were fully vaccinated, while an additional 4,153,143 people received their first vaccine dose [276]. Singapore currently has one of the best vaccination rates in Asia. The government’s approach is to marry re-opening phases with vaccination milestones: 50% of the population is expected to be vaccinated by the second half of July and so further opening is expected to occur from then onwards; similarly two-thirds of the population is expected to be fully vaccinated by 9 August (Singapore’s National Day) which will also coincide with the relaxation of more rules [295].

In December 2020, Singapore authorised the Pfizer-BioNTech vaccine for individuals aged 16 and above, and this was extended to individuals aged 12 to 15 years on 18 May 2021 [296]. On 3 February 2021, the Expert Committee on COVID-19 Vaccination welcomed the interim authorisation of the Moderna COVID-19 vaccine, for use in Singapore in individuals aged 18 years and above [297]. On 16 June 2021, the government announced that certain private healthcare institutions would be allowed to administer the Sinovac-CoronaVac COVID-19 vaccine [298]. This vaccine remains unregistered and is not authorised by the HSA for use under PSAR but is provided through the Special Access Route (SAR). The MoH opened up the SAR to allow for the import and supply of unregistered medicines to address unmet medical needs, as there has been interest to access alternate vaccines, mostly due to medical reasons which prevent individuals from taking the two authorised mRNA vaccines. In June 2021, insurers extended their coverage of hospitalisation resulting from COVID-19 vaccine complications to include vaccines brought under the SAR [299].

Singapore rolled out a progressive vaccination system, with priority for vaccination given to those at greater risk first, including healthcare and frontline workers as well as vulnerable groups such as the elderly. The vaccination policy was gradually extended to those at higher risk of exposure and with multiple community touch points, such as educators, delivery staff, and taxi drivers. Concurrently, the nation-wide vaccination drive was first offered to more senior age groups and eventually trickled down to the youth, with first preference given to Singapore citizens. On 31 May 2021, the vaccination guidelines were updated based on the latest scientific evidence: vaccinations, which were previously not available to certain groups, are now offered to pregnant and breastfeeding women, cancer patients on active treatment, and people with Severe Cutaneous Adverse Reactions [300, 301].

Singapore’s vaccine registration and administration process is efficient. Individuals will be nominated by the government to be vaccinated when they are eligible or can register their interest to be vaccinated at vaccine.gov.sg. A SMS with a personal booking link to book a vaccination appointment on the National Appointment System will then be sent to invite eligible individuals. Singapore has transformed many public spaces, such as community centres and halls, into vaccination centres. Upon arrival at a vaccine centre, individuals are screened and briefed, receive their vaccine, and then are monitored for side-effects for 30 minutes [302].

Singapore’s top priority in its race against COVID-19 is to speed up vaccinations. The government highly encourages vaccination because it reduces the probability of getting the virus and even if infected, symptoms are mild. To encourage vaccination specifically among the elderly, vaccination
centres began to accept walk-ins, without the need for prior registration, for individuals aged 60 and above from 31 May 2021 [303]. To facilitate the vaccination of people confined to their homes, who are unable to travel to a vaccination site, MoH has worked with the Health Promotion Board and the Agency for Integrated Care to deploy home vaccination teams, comprising a doctor and a nurse, to vaccinate these people at their homes [304]. In addition, to provide vaccines to more people, the Multi-Ministry Taskforce announced on 18 May 2021 that it will be prioritising first doses of the vaccines and extending the interval between the first and second doses from 3 or 4 weeks, to 6 to 8 weeks, as other stocks of vaccines fly in by mid-June [305]. This approach would quickly provide the maximum number of people with good protection, instead of a good number of people with maximum protection. On 26 June 2021, the Health Minister announced that the vaccination program will be ramped up from administering 47,000 doses daily to 80,000 doses daily as the delivery of vaccine supplies were brought forward. From 2 July 2021, the vaccine program was extended to the rest of the population [306] with the interval between doses being reduced back to 4 weeks to speed up vaccination coverage. The government provides resources online with factual data and frequently asked questions about vaccines and updated policies, so that Singaporeans can make well-informed decisions about their vaccinations and health. See Fig. 13 for Singapore’s vaccination journey.

To realize its vision of an endemic COVID-19 era, Singapore is taking inspiration from Israel which has achieved a high vaccination rate and has brought the clinical outcomes of COVID-19 close to that of a seasonal flu. The government predicts that a minimum vaccination coverage of 70-80% is required, ideally with higher vaccination rates among the elderly and the vulnerable, to reach herd immunity and further open the country’s borders [307]. The government is being very cautious and does not want to prematurely open the economy as it could result in overwhelming healthcare systems and higher mortality among vulnerable groups. In the future, booster shots may be required to defend against new mutant strains, vaccinated individuals may enjoy more relaxed regulations than unvaccinated individuals, and health and urban policies may be reformed to include measures such as vaccine passports as the country transitions to its “new normal” [308].
7.5 Testing and contact tracing

In addition to vaccinations, testing and contact tracing are the other key pillars of Singapore’s strategy to control the infection. Singapore is continuing to enforce stringent monitoring and surveillance measures, such as contact tracing for identifying close contacts, instructing those who live with people under QO to self-isolate, and testing people who visit COVID-19 hotspots on same days as confirmed cases [309]. Positive individuals or close contacts are assessed through a combination of tests and clinical observations before determining the public health action to be taken. As of 12 July 2021, Singapore recorded a total of 14,751,144 swabs tested [276].

**Antigen rapid test (ART)**

From May 2021 onwards, the government increased surveillance testing using ARTs. ARTs are meant to complement existing testing regimes, such as RT-PCR testing, because they are cheaper, faster, and more convenient to administer even though they are less sensitive. This allows for expanding the scale of testing. As a result, ARTs were deployed for regular testing of workers in dorms, construction sites, airports, marine shipyards, student hostels, workplaces, elderly home care
centres, and selected malls [310]. On 10 June 2021, the HSA encouraged companies to provide clinical and efficacy data of their ARTs in order to attain approval under PSAR, in an attempt to rollout more ART self-test kits and expand their usage [311]. From 16 June 2021 onwards, four types of ART self-test kits gained HSA approval and were available in retail pharmacies. Individuals who do not have ARI symptoms but are concerned they may have COVID-19 can procure a self-test kit over the counter, and if positive, should immediately approach a SASH PHPC to get a confirmatory PCR test. They are then required to self-isolate until they receive a negative PCR test result. Individuals who have ARI symptoms are instructed to visit a doctor for a full diagnosis and get a PCR test instead of relying on an ART self-test kit.

*Fast and easy test (FET)*

From June 2021 onwards, there has also been a phased roll out of regular FETs, which include ARTs, for staff involved in higher-risk activities. From mid-July 2021, staff who work at settings with unmasked clients, such as restaurants, personal care services like facial services, gyms, and fitness studios, will be required to start a 14-day FET regimen [312]. To support this, the government is launching training programs for employers and employees on the supervision and administration of self-swabs. The government has also made provisions through the setup of Quick Test Centres for small businesses that are unable to organize supervised self-swabs on their own.

*Research & development*

The local R&D players, including A*STAR and the National University Health System, are working together to boost the national capacity for larger-scale COVID-19 testing and are exploring other testing possibilities such as saliva tests, sniffer dogs and wastewater surveillance [313]. In addition, A*STAR and the Singapore government are exploring partnerships with other ASEAN countries to ramp up regional preparedness [314]. The Temasek Foundation is also actively supporting national preparedness efforts; for instance, by providing a free oximeter to all households in Singapore to allow residents to monitor their blood oxygen regularly [315]. Furthermore, local universities and start-ups have collaborated to develop breathalyzers (see Fig.14). In particular, there are 2 players in the field: Silver Factory Technology is a spin off from Nanyang Technological University and Breathonix is a start-up from the National University of Singapore [316, 317]. Breathalyzers provide immediate results and have been deployed in Changi Airport and at other borders.
Fig. 54: Working of breathalysers developed by Silver Factory Technology

Detecting Covid-19 in a single breath

Breathalysers developed by medtech start-up Silver Factory Technology employ vibrational spectroscopy to identify Covid-19 infections. This technology identifies the molecular fingerprint of volatile organic compounds present in the exhaled breath of individuals who have Covid-19. Clara Chong looks at how this works.

• Exhaled breath contains thousands of volatile organic compounds.
• Different diseases, viruses or bacteria will alter the composition of these compounds.
• Viruses like Sars-CoV-2, which causes the Covid-19 disease, will cause an infected person to exhale a distinct composition of compounds. These compounds will be detected by the breathalyser.

HOW IT WORKS

1 An individual breathes into a breathalyser, equipped with infection-control features, for around 10 seconds.

2 The breathalyser is disinfected and inserted into a portable reader and the analysis is completed within two minutes.

3 This reader identifies the distinct compounds that are unique to Covid-19.

4 Statistical analysis is then done by the reader to identify individuals with Covid-19, and a readout is generated.

5 The breathalyser is disposable and will then be safely discarded.

ABOUT THE BREATHALYSER

• Benchmarked against polymerase chain reaction tests – considered to be the gold standard for testing – Silver Factory’s breathalyser has a...
  - sensitivity of over 95 per cent
  - specificity of over 99 per cent
• Large-scale manufacturing of the breathalysers will start in June.

Source: SILVER FACTORY TECHNOLOGY
ST PHOTOS: JASON QUAH
STRAITS TIMES GRAPHICS

Testing and contact tracing in the “new normal”

As the delta variant continues to circulate, the government is adopting an aggressive ring-fencing strategy to minimize the risk of large clusters forming by casting a wide net to isolate contacts of infected people and testing extensively especially at borders. The approach to testing and contact tracing will shift from being reactive to proactive. Instead of only testing when a new case appears, routine and regular testing will also occur in normal settings, such as at workplaces, events, and social gatherings. This will eventually enable overseas trips and large-scale events to take place in the future. Therefore, routine, large-scale, fast, and simple testing will be part of Singapore’s “new normal”.

7.6 Border controls

Singapore actively monitors the global situation before deciding upon border controls and travel restrictions. As of end-June 2021, travel restrictions differ based on the traveler’s nationality and travel history. Singaporean citizens and permanent residents may return to Singapore from any country but will have to follow certain health measures upon entry depending on where they come
from. Long-term pass holders and immediate relatives of citizens/permanent residents, except for those from Bangladesh, India, Nepal, Pakistan, and Sri Lanka due to the upsurge in cases in these countries, can apply for entry approval to enter Singapore. Short-term business visitors and short-term travelers from Australia (excluding Victoria State), Brunei, Mainland China (excluding Guangdong province) and New Zealand can enter via the Air Travel Pass travel lane. In addition, the RGL is open to travelers from certain provinces in Mainland China but travelers have to follow controlled itineraries within Singapore as part of this travel lane. Finally, travelers from all countries may enter Singapore on a short-term basis to attend to a family crisis, such as death or critical illness of a family member in Singapore [318, 319].

Singapore primarily opens borders only to countries that have kept the pandemic under control through the use of RGLs and travel bubbles. For example, in late 2020, Singapore and Hong Kong reached an agreement to establish a travel bubble between the countries in which travelers would face no restrictions. However, due to the constantly evolving situation in both countries, the bubble has been deferred until further notice [320]. The country constantly tweaks border controls based on the evolving situation, but the eventual goal is to open up more based on the country’s vaccination, testing and contact tracing capabilities. The Prime Minister hopes doors can start to open by the end of 2021 or early 2022. In the “new normal”, individuals may not be able to spontaneously make travel plans but will have to carefully plan for it and provide vaccination documentation if they wish to travel.

7.7 Economy

In 2020, Singapore faced one of its worst recessions with the economy shrinking by approximately 5.4%. However, the Monetary Authority of Singapore projects that the economy will expand by 6% or more by the end of 2021. Employment figures have inched up and the unemployment rate is falling; however, the recovery is disparate across sectors. For instance, strong growth is expected for the manufacturing sector which is experiencing rising global demand while prospects for sectors like the aviation industry are deteriorating [321].

The tourism industry has also been hit. Several local and global events were cancelled in Singapore due to the pandemic. For example, the World Economic Forum was scheduled to happen in Singapore from 25 to 28 May 2021, instead of its traditional home in Switzerland which was battling a rise in cases, but the event was eventually cancelled with the World Economic Forum citing global uncertainties due to the pandemic [322]. In addition, the Formula 1 Singapore Grand Prix was cancelled for the second year in a row [323] and the Football Association of Singapore announced cancellation of the 2021 Singapore Cup [324].

Singapore has continued to provide several schemes and economic support to various industries to strengthen them. Business support includes eased terms for loan repayments for high growth enterprises, skill-based training workshops for leaders from mature enterprises, and co-investments from the government and Temasek Foundation for strengthening large local companies. For households and families, the government provides various types of vouchers and additional support to the elderly, low income families, and children with special needs [325]. For workers and job seekers, the COVID-19 recovery grant financially supports workers who lost their jobs due to the pandemic and are facing income difficulties. In addition, the government has extended the Jobs
Support Scheme for individuals until mid-July 2021 due to the continued tightened safe management measures in place during Phase 3 (heightened alert). To provide targeted support to hawkers who are self-employed, the government also extended the subsidies for fees for table-cleaning and centralised dishwashing services as well as rental waivers till mid-July 2021. The COVID-19 Driver Relief Fund was also extended for taxi and private hire car drivers with financial stipends for a few more months [326].

7.8 Pandemic preparedness for the future

Singapore prides itself on efficiency and strong leadership. The government is forward-looking with the priority to not only rise out of this pandemic in the present but to also plan for the future. Local ministers believe lessons learnt from the COVID-19 pandemic should be leveraged on to build future preparedness and resilience. In particular, three key lessons have been highlighted by the government so far.

The first key insight is that countries cannot afford to slacken their pandemic responses and prematurely relax rules. Infectious diseases can be challengingly unpredictable since microorganisms can mutate. As a result, each time a country thought it had the COVID-19 situation under control, the virus reappeared in a new direction. In Singapore’s case, it reappeared as a variant strain or in a new avenue, such as at migrant worker dorms or institutes of education. To combat this, Singapore’s approach has been to survey the constantly evolving COVID-19 situation very closely and to tweak its safe management measures in response to this, enabling a very cautious re-opening [327].

The second incontrovertible fact is that preparedness and prior experience helps. In Singapore’s case, dealing with SARS in 2003 helped prime the country’s healthcare systems and collective response during pandemics. The cost of investing upstream to prevent a pandemic is miniscule compared to the cost of failing to invest. Strengthening health systems and implementing an effective surveillance and alert system are key defences to prevent pandemics. As a result, Singapore is investing in new capabilities, such as digitalisation efforts and R&D investments. An Emerging Stronger Taskforce was also set up to chart Singapore’s economic recovery post COVID-19 [328]. Additionally, the government announced plans for an after-action review to analyse the government’s response to COVID-19, acknowledge shortcomings and successes, and learn valuable lessons to improve future pandemic responsiveness [329]. The Prime Minister acknowledged that COVID-19 is not the worst pandemic to come and pandemic preparedness should be sustained during peace time to allay fears during pandemics.

The third lesson is about the importance of international cooperation. As countries scrambled for personal protective equipment and vaccine doses, global supply chains and manufacturing capacity became vital. The Singapore government believes that beyond individual efforts, regional and international partnerships are required to fuel international scientific cooperation and initiatives like COVAX. The fates of countries are intertwined and only a concerted global effort can overcome pandemics. Hence on 21 May 2021, Singapore’s ministers attended the Global Health Summit where they supported the Rome Declaration of principles to strengthen global health infrastructure and collective resilience through multilateral collaborations [330].
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