



# COVID-19 Our Experience In and Beyond SGH

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Dy GCEO SingHealth (Organisation Transformation and Informatics)**

Singapore Healthcare Management 2020

# Singapore and SingHealth



	Singapore General Hospital		Sengkang General Hospital
	National Cancer Centre Singapore		National Heart Centre Singapore
	Singapore National Eye Centre		National Neuroscience Institute
	Changi General Hospital		KK Women's and Children's Hospital
	SingHealth Community Hospitals		Polyclinics SingHealth
	National Dental Centre Singapore		

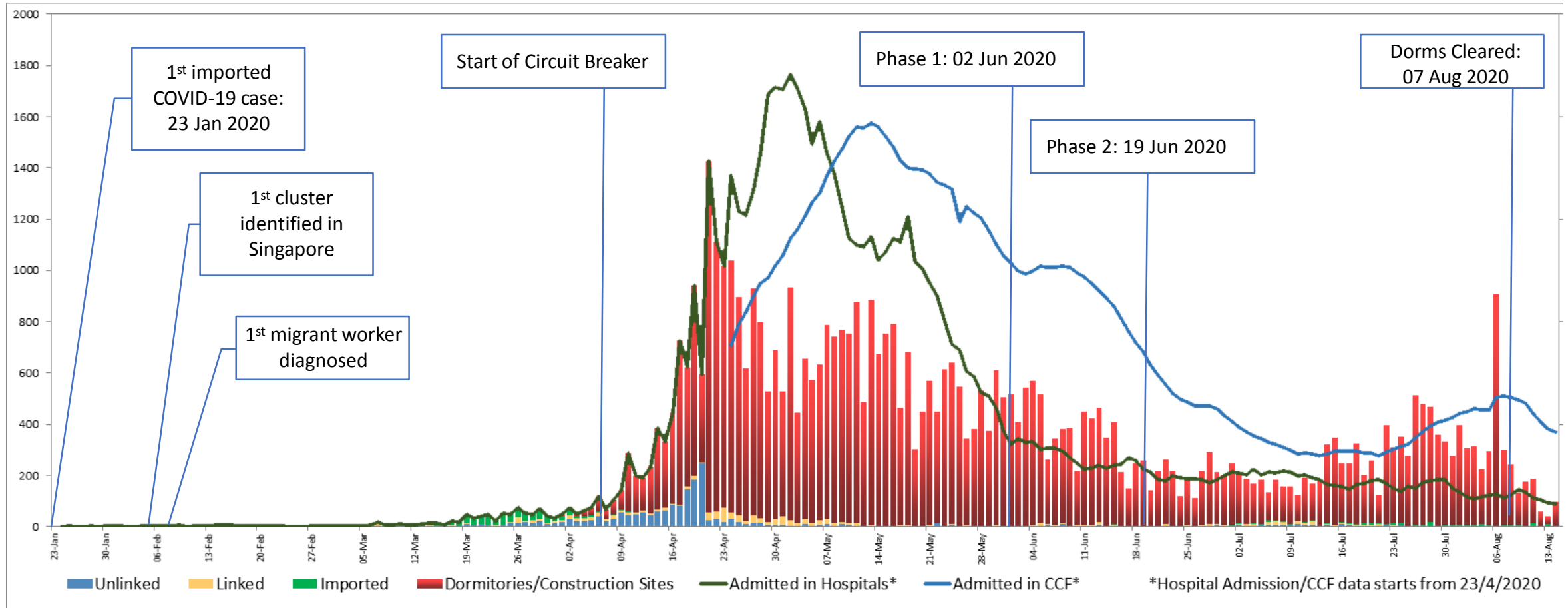
# Singapore COVID-19 Timeline



## COVID-19 Situation Report

Data Updated as of: 17 Aug 2020

Total Cases	Active Cases	ICU	General Ward
55838 ▲91	3461 ▼306	0 -	82 -
In Isolation	Discharged (Hosp)	Completed Isolation	Demised
3379 ▼306	2208 ▲1	50142 ▲396	27 -



# Framework



# Framework



# Creating Capacity



Attempt to create capacity in anticipation of need



Segregated flows for COVID-19 and non-COVID-19 cases



Patients and colleagues must be kept safe



Capacity must be fit for purpose

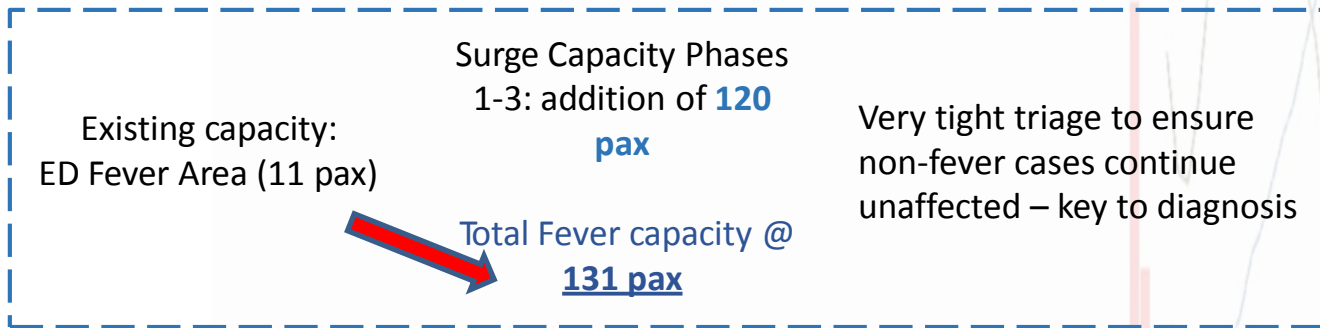
- Isolation, safe distancing
- Cohorting, shared toilets
- “Good enough” – cost and speed considerations



Flexibility in deployment



# Emergency Department Capacity



## THE STRAITSTIMES

Singapore confirms first case of Wuhan virus; second case likely



First Covid -19 Case

(23 Jan)

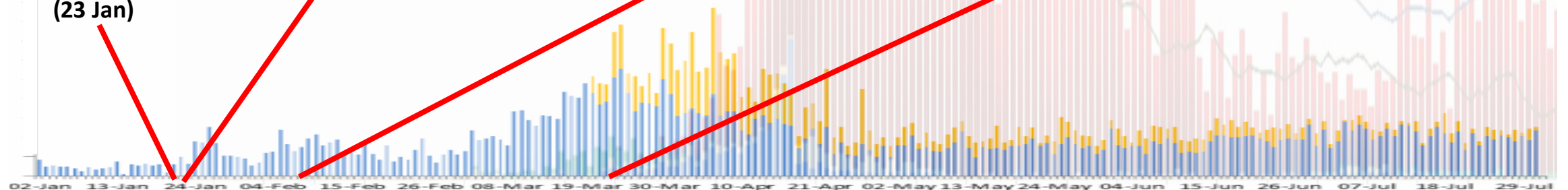


ASC converted to fever screening area (+ 42 pax)  
**Surge Capacity Phase 1 (25 Jan)**

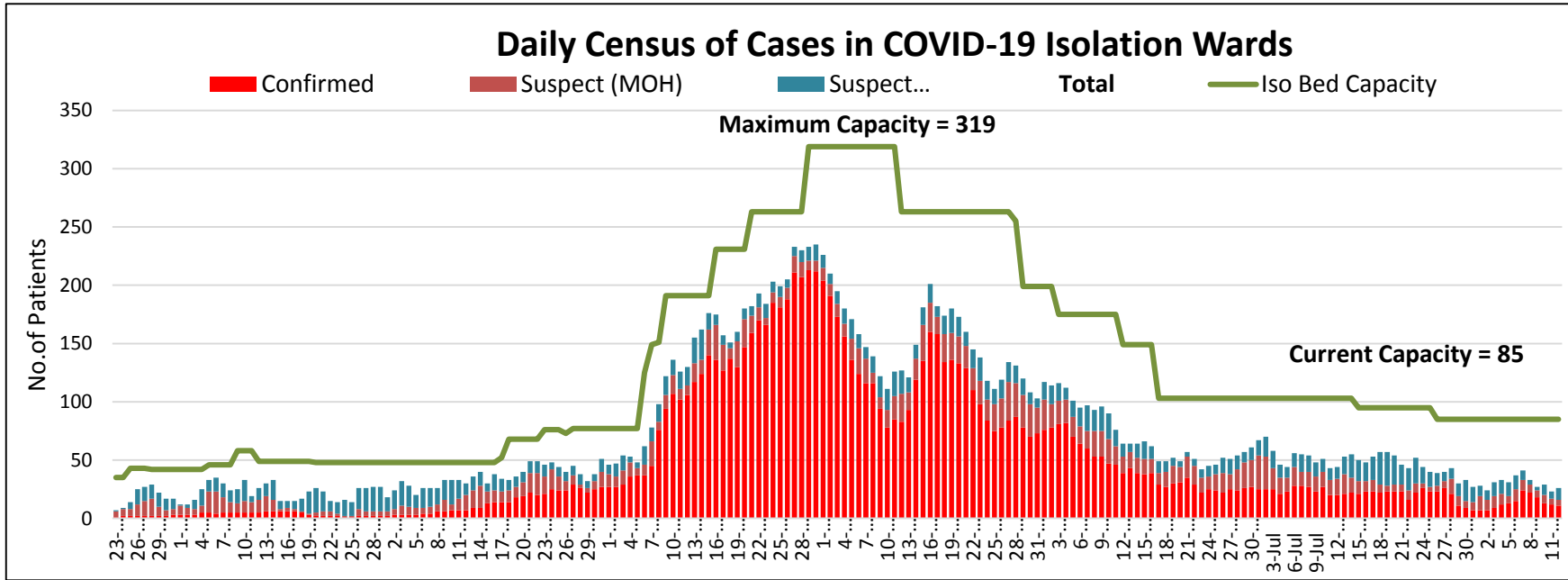


Linkbridge to OCH converted to ED NOK holding area and FSA (+ 12 pax)  
**Surge Capacity Phase 2 (09 Feb)**

FSA at Carpark H (+ 66 pax)  
**Surge Capacity Phase 3 (20 Mar)**

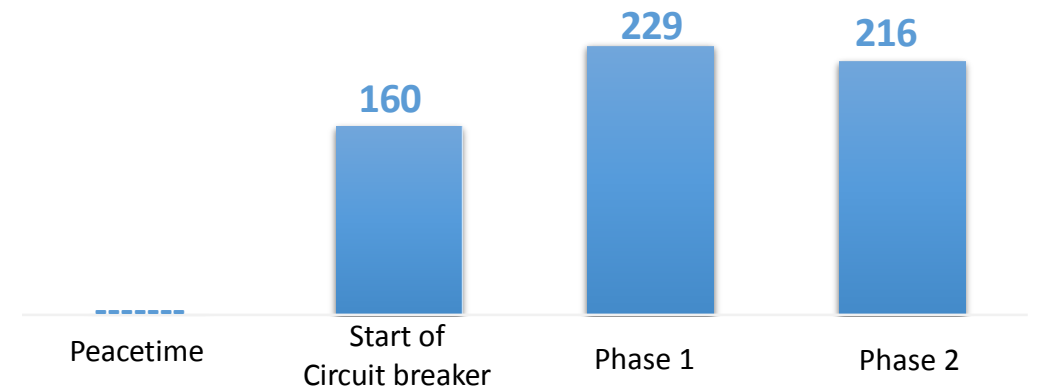


# Inpatient Bed Capacity



- **Activation Outram Community Hospitals beds** to create more beds capacity (~250 beds)
- **Deferment of non-essential** SOC appointments and electives admissions/surgery

## Acute Respiratory Infection Beds





# Adjustment of Healthcare Services to Situation

## CONTINUATION OF ESSENTIAL HEALTHCARE SERVICES DURING PERIOD OF HEIGHTENED SAFE DISTANCING MEASURES

4TH APR 2020

### Healthcare Services

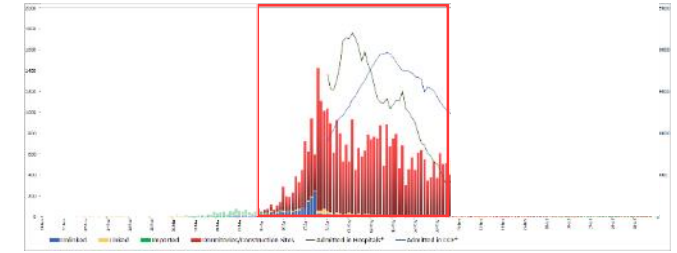
2. All public and private acute hospitals (including offsite specialist clinics and offsite Ambulatory Surgical Centres), community hospitals, polyclinics, Public Health Preparedness Clinics (PHPCs), and renal dialysis centres will remain open for the delivery of essential services.<sup>[1]</sup>

### 1 During Circuit Breaker (07 Apr – 01 Jun)

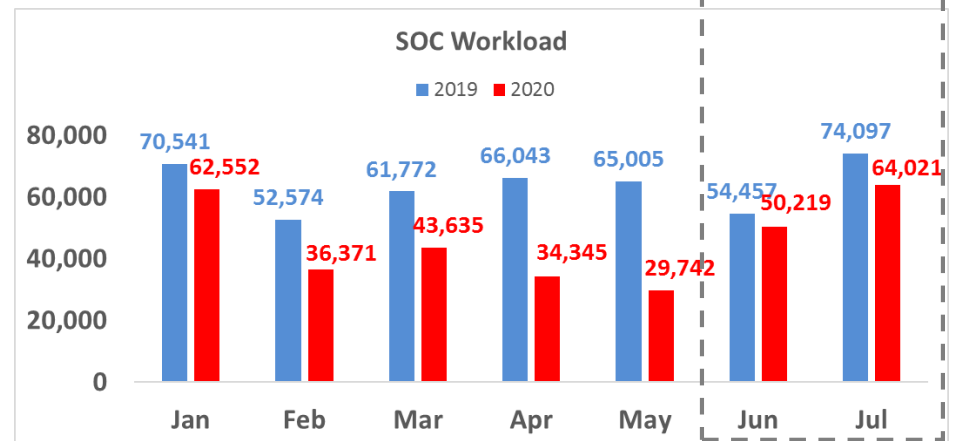
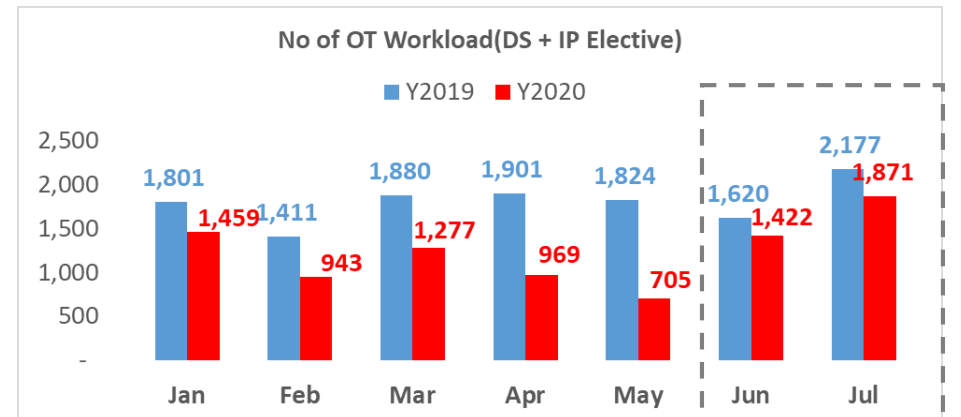
- Cases which cannot be deferred more than 2 weeks
- Deployed 3 Urology OTs as COVID 19 OTs

### 2 After Circuit Breaker (02 Jun onwards)

- Gradual ramping up of services
- Cases which cannot be deferred by 4 weeks



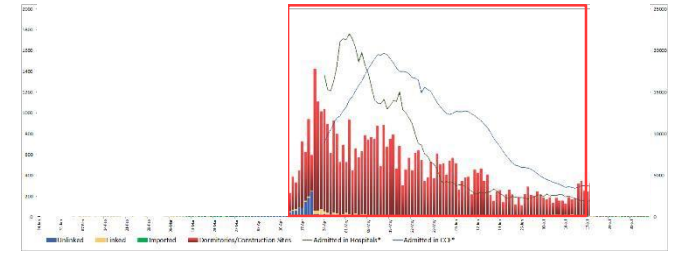
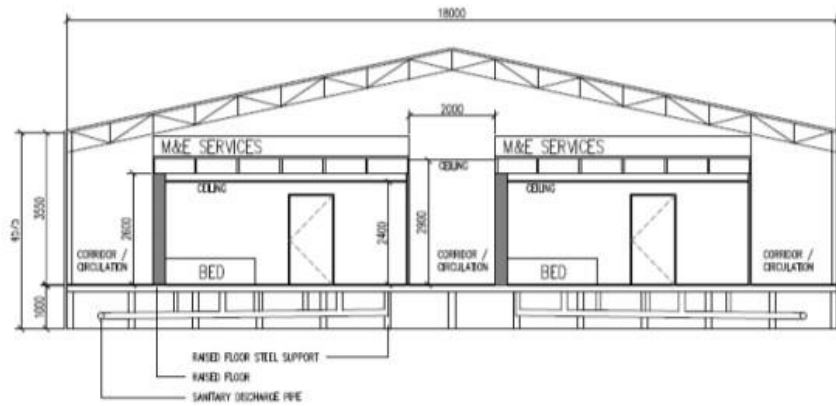
*Circuit Breaker from 07 Apr – 01 Jun'20*



*Post circuit breaker*

# Creating New Capacity

From Carpark to Ward – 50 negative pressured isolation rooms in **50 days**



50 single units

- Negative-pressure
- Airconditioned
- Ensuite toilet and shower
- Piped Oxygen
- Remote monitoring
- Bedside tablet



# Ramping Up Our Lab Capacity

## 1 Capacity

- Usual PCR testing 140/day
- Capacity now of 1,600 tests/day – 11-fold increase

## 2 Operating Hours

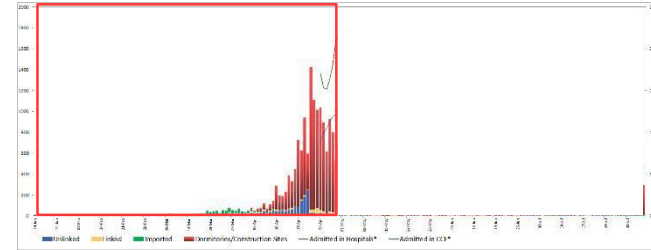
- Long hours (staggered), 7 days a week
- Staff rostered on call 24/7 for urgent tests

## 3 Supply chain

- Ensure sustainability of consumables and devices

## 4 Buffer Capacity

- Possible surge in testing and possibly cases



*Current lab capacity from 24' Apr 2020 = 1,000  
Maintained lab capacity of 1,000 tests/day*



# Framework



# Developing Capability



## Clinical Capability

- Prepared to ramp up from 62 to ~214 ICU beds
- Room, equipment, people (ICU course), consumables

## Infection Prevention and Control

- PPE and IPC practice, Safe Distancing
- Contact tracing, mask fitting

## Leadership Capability and Teaming

- Developmental opportunity – trial of fire
- Recognition of co-dependency
- Building trust

## Innovation and Creativity

- Necessity is the Mother of Invention

# Developing Capability and Capacity

## SGH Campus Approach

- Trust and Understanding
- Collaboration and Teamwork
- Coordinated effort by joint team from
  - SGH
  - NDCS
  - SNEC
  - NCCS
  - NHCS
  - NNI
- All SingHealth institutions collaborating, sharing, exchanging with all clusters





# Testing Capability

## 1 Manpower

- Cross-training of colleagues – other labs, research labs

## 2 Tests and Systems

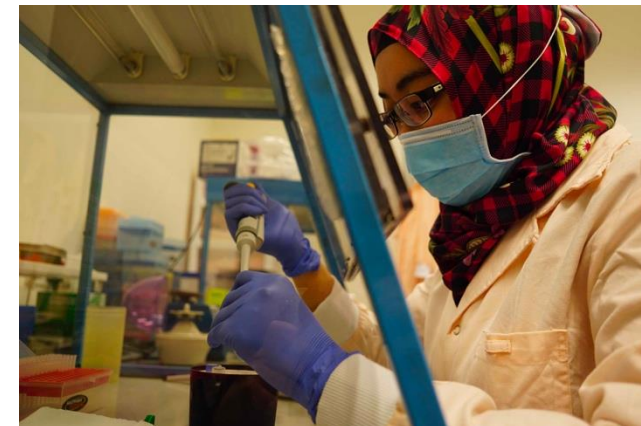
- Started with in-house testing based on WHO test
- MOH-developed test
- High throughput platform (1-2-3 machines)

## 3 Digitalisation of Process

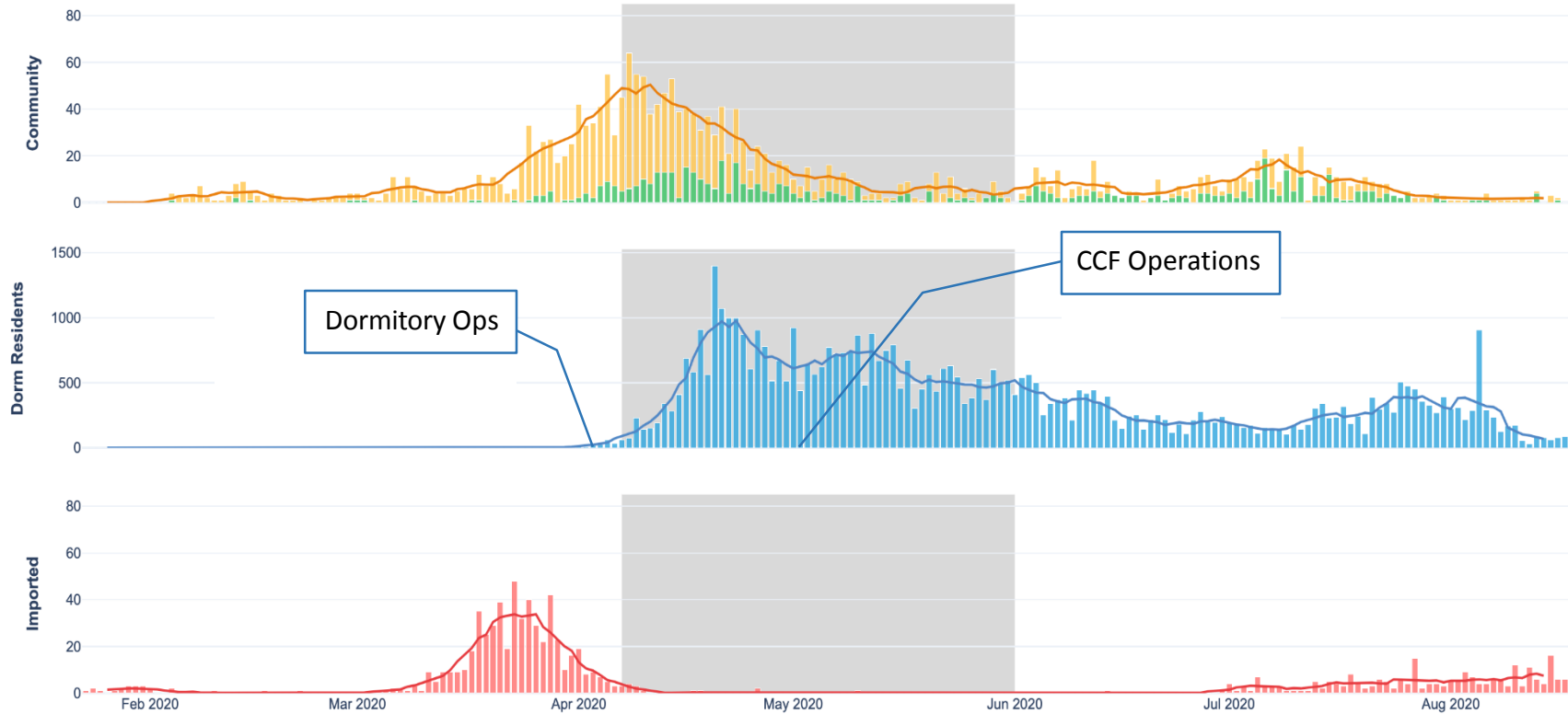
- Registration, labelling, lab tracking
- From paper to laptop

## 4 Consumables

- Dacron swabs, Copan/Miraclean swabs
- 3-D and IM swabs



# Role Beyond the Hospital



Moving Upstream

- reduce attendance
- bypass admission



Moving Downstream

- facilitate discharge
- bypass admission

# Supporting External Operations

- Sharp rise in the number of cases in the dormitories
- Essential to move Upstream to manage COVID-19 patients
- National effort to support more vulnerable
- Deployment of staff to the following:
  - **8 Dormitories** - ~40,000 patients seen
  - **2 Swab Isolation Facilities** (SIFs)
  - **1 Community Care Facility** (CCFs)
- Provide essential primary care and screening - swab testing

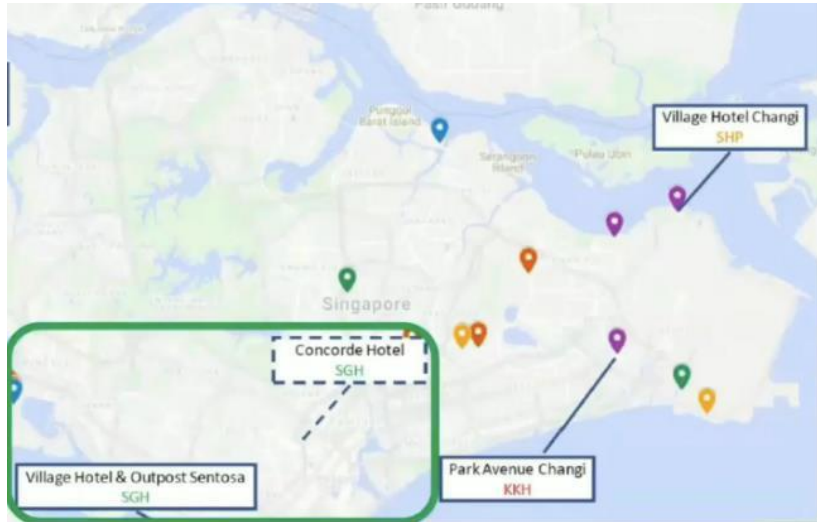
## Dormitory Operations





# Swiftly Swung into Action to Support External Ops

## Swab Isolation Facility



## Community Care Facility - Expo



# Swiftly Swung into Action to Support External Ops

## Objectives in Community Care Facility (CCF):

- Zero transmission to Healthcare Workers
- Zero adverse event to patient
- Innovate to:
  - ✓ *Reduce transmission risk*
  - ✓ *Good patient experience*
  - ✓ *Enhance value*

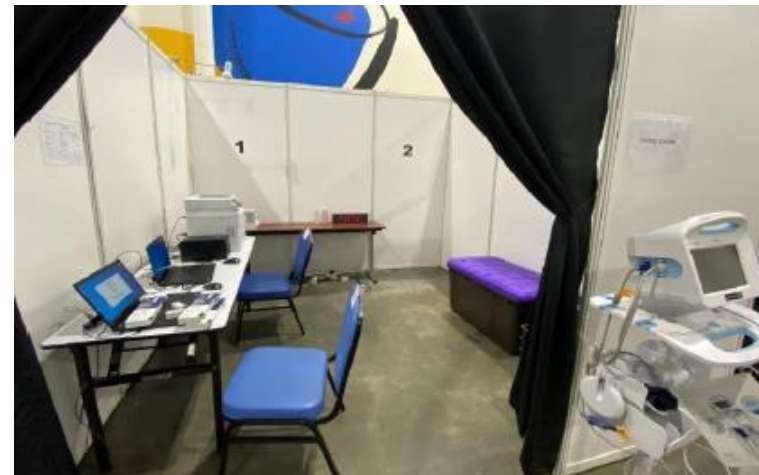


### Coronavirus: Temi reduces exposure of healthcare staff to patients

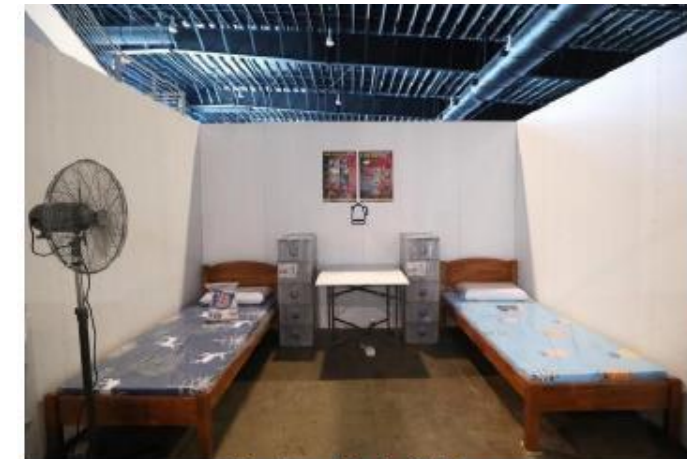
By Timothy Goh  
16 Jun 2020 | Tomorrow's Medicine, The Straits Times



A patient at SingHealth's community care facility at the Singapore Expo having a teleconsultation via Temi, a remote-controlled robot. PHOTO: SINGHEALTH



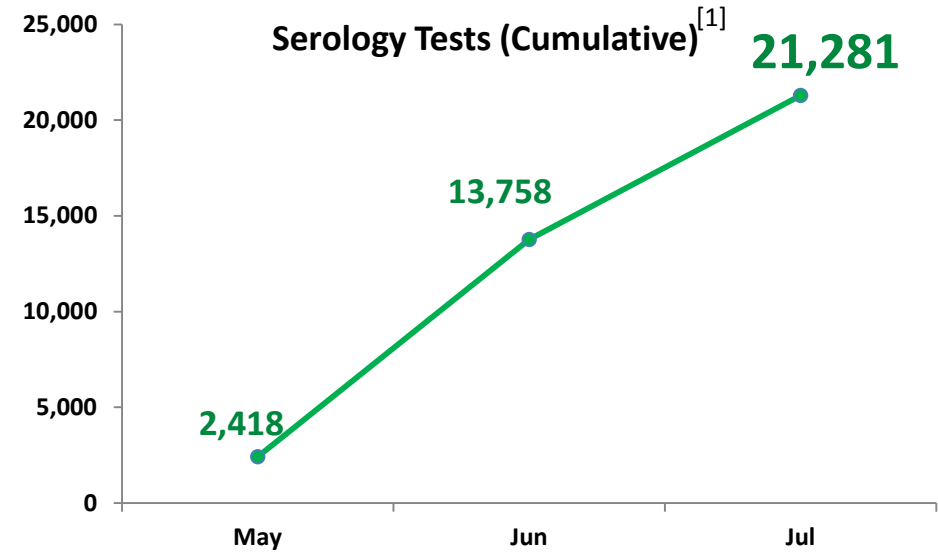
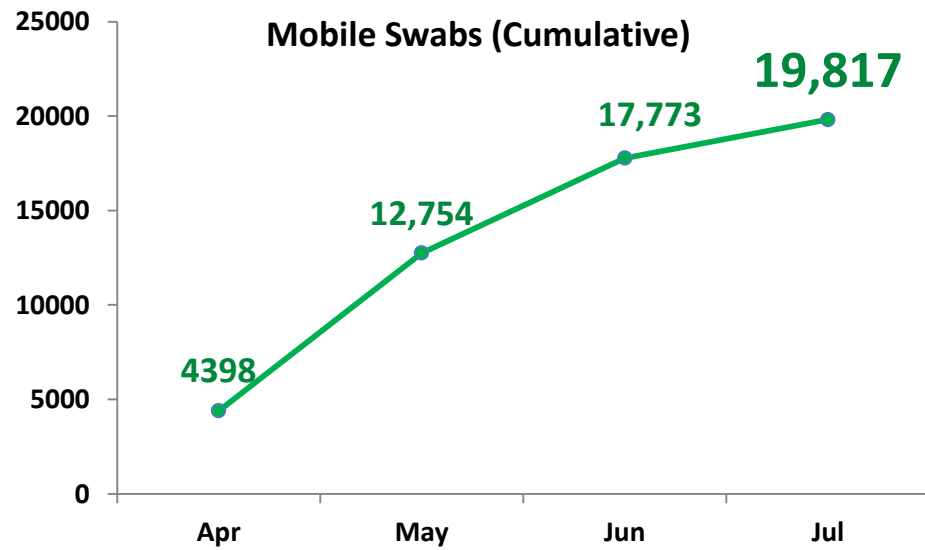
Nurse Station



Patient's Cubicle



# Conducted ~20,000 mobile swabs and mass serology tests



[1] Based on number of tests conducted by SGH Serology Team



# Relatively Low Case Fatality and Population Fatality

Population Fatality (per 100,000 people):

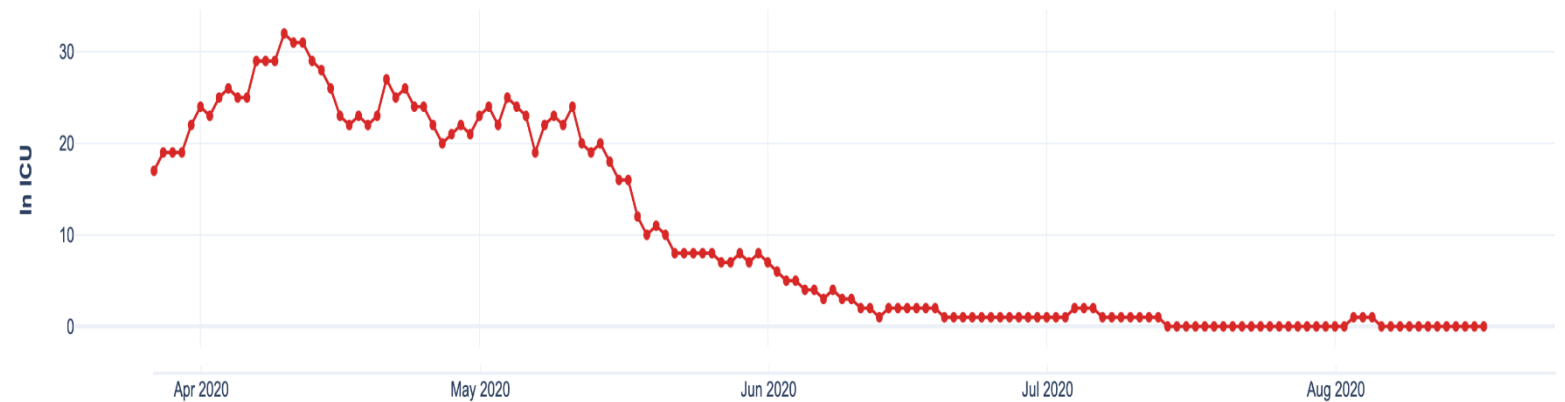
**0.47**

As of 2019, population of SG is 5.70 million<sup>[1]</sup>

Case Fatality Rate:

**0.05%**

(27/55,104)



[1] Department of Statistics Singapore

# Framework



# Leadership Structure

## Concerted National Effort - MMT (Multi-Ministry Taskforce)



- **Early recognition of value of coordination and load levelling at national level – patients and staff**
  - Standardised criteria for
    - Suspect cases, admission, testing,
    - Transfer to step-down care facilities
    - PPE usage
  - Engagement and 2-way communication
  - Consolidation and/Rationalisation of
    - Supply chain and procurement
    - Manpower and resource deployment

## SingHealth Disease Outbreak Taskforce (SDOT)

- Cluster and Institutional Leadership
- Domain Leads
- Reporting and tracking outcomes and supplies
- Harmonisation of Policies
  - PPE, IPC
  - HR



*SDOT visit to Ward@Bowyer*



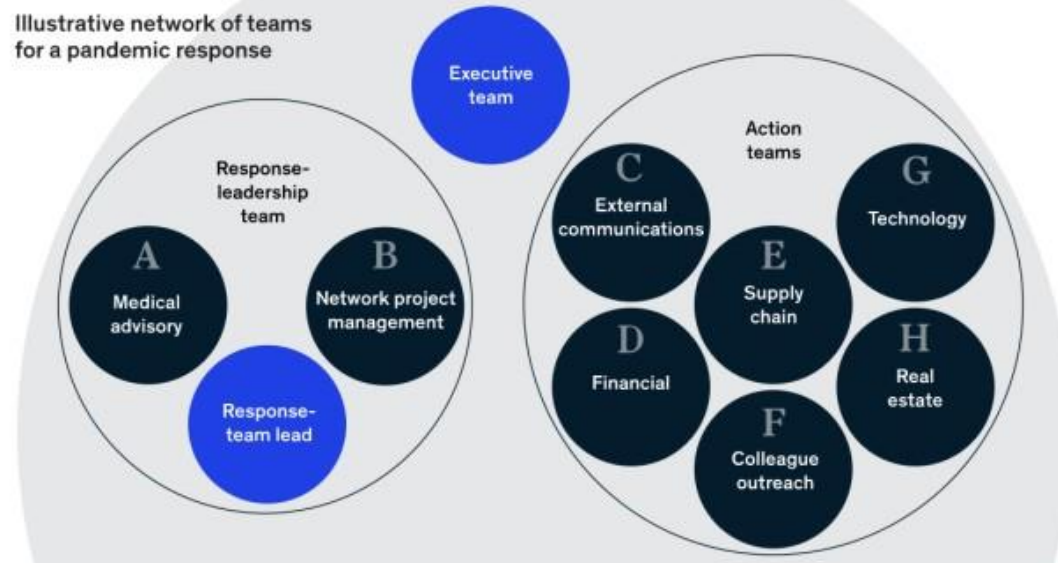
*SDOT preparing gift packs for staff*

# Crisis Leadership – Establishing Authority of Domain Experts

## “Central Focus on COVID-19”

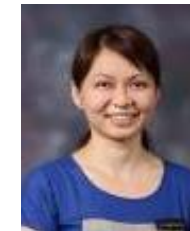
During a crisis, a network of teams carries out responses outside of normal operations, as well as adjustments to routine business activities.

Illustrative network of teams for a pandemic response



Source: McKinsey & Company

- Early establishment of command center to navigate whirlwind of activities
- Collective leadership with a flattened hierarchy
- Primarily led by domain experts e.g. ID & IPE while Management took a supportive role
  - Clinical protocols continually reviewed



From L-R: Infectious Disease department led by Dr Tan Thuan Tong, Dr Limin and Dr Indumathi



W68 Nursing Colleagues



Preparedness & Response Colleagues



Prof Tan Ban Hock,  
Chief Quality Officer,  
SGH



Dr Ling Moi Lin,  
Infectious Prevention  
& Epidemiology  
department

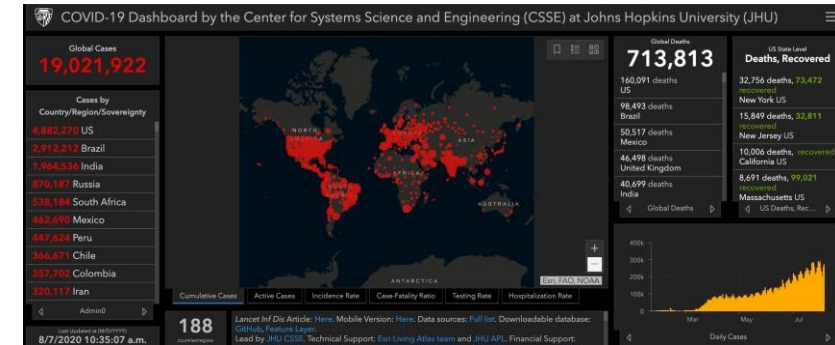


Dr Kenneth Tan,  
Department of  
Emergency Medicine



# Decision Making is Backed by Data

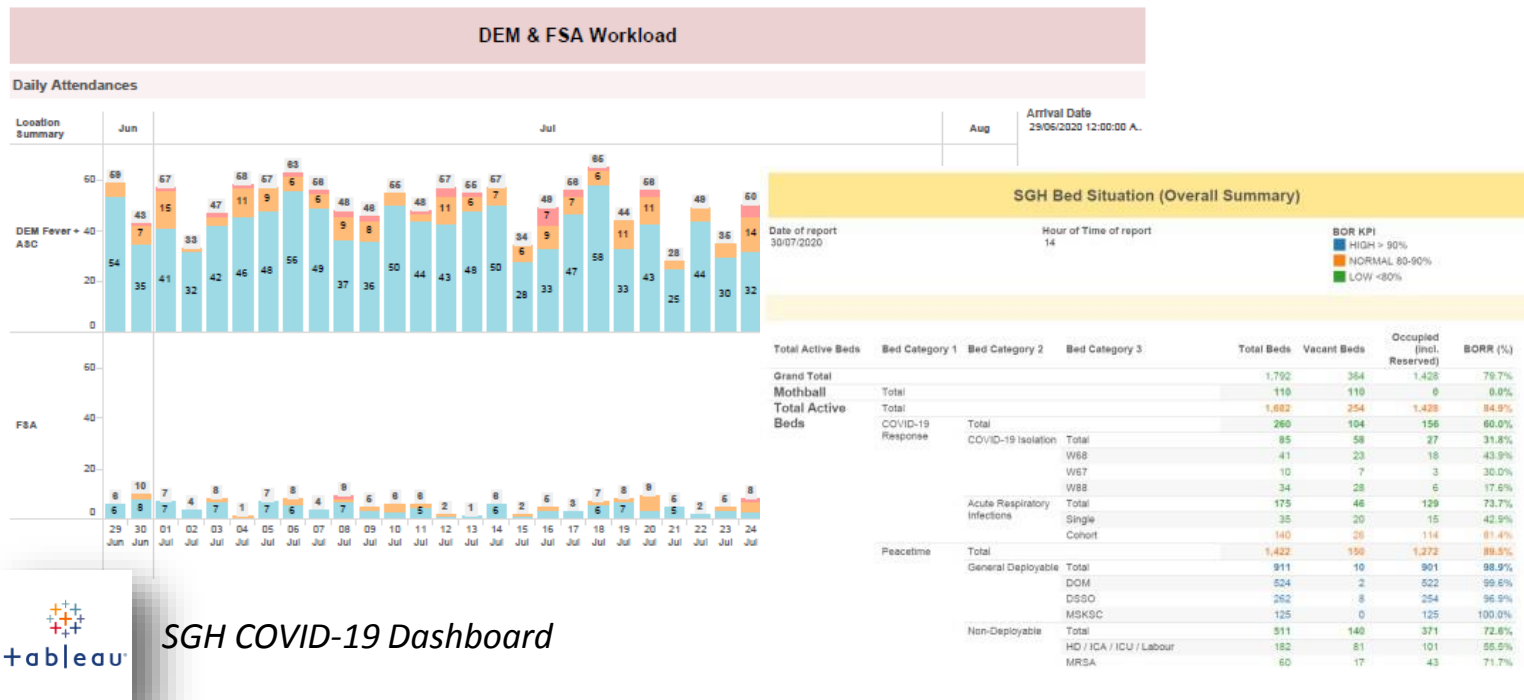
- ✓ Taking reference from Global & National Intelligence
- ✓ Launch of thrice daily **COVID-19 Dashboard** with the use of Tableau Visualizer Tool
  - Reduce increasingly laborious manual efforts
  - Reduce strain on duplicative reporting across frontline departments
  - Provide a holistic one-source view of key reporting metrics of Covid vs Non-covid for management oversight



John Hopkins University COVID-19 Dashboard



UpCode Academy SG COVID-19 Dashboard



SGH COVID-19 Dashboard



# Framework





# Our people are our greatest asset

*Take care of colleagues and allow them to do what they are passionate about... "can-do" spirit!*

## Physical Safety

Zero tolerance for hospital transmission of COVID-19

- ✓ Provision of PPE
- ✓ Safe distancing, minimizing contact with COVID patients
- ✓ Scaling up of Staff Clinic
- ✓ Heat map of ARI reporting sick encounters by healthcare workers

## Wellness & Emotional Health

SGH SAFE: COVID self-care series

- ✓ Address issues with isolation, stigma fatigue
- ✓ Encouragement & appreciation for staff
- ✓ Emotional support
- ✓ Open channels for feedback



## Autonomy & Mastery

Empower our people

- ✓ Providing support for ideation & pilots for innovative projects / initiatives
- ✓ Encouraging ownership of patient care



# Our people were resilient, proactive and supported each other



## ***Proactive***

- ✓ SGH Community Nurses deployed to ED & inpatient areas
- ✓ Research colleagues deployed to labs
- ✓ Surgeons taking on new roles at external ops



Staff Volunteers for perimeter screening



## ***Going the extra mile***

“Nurse Suriana Sanwasi and her family members first used their own funds to buy trollies of toiletries, towels and snacks.

Nurse Suriana shared that migrant workers transferred to the Community Isolation Facility (CIF) also needed new sets of clothes as they had to change to reduce risk of virus transmission from the stained clothes.

Colleagues and friends then chipped in, multiplying the family’s efforts.”

## ***Resilience***

“Swat” teams of junior doctors from different disciplines deployed at isolation ward. Each team worked in 12 hour shifts for a cycle of 10 working days before taking a break



## ***Compassion***


Radiographer playing a game of carrom with resident at Expo

# Communication of Key Critical Information

S/N	Item	Guidelines / Work Processes for Implementation (New / Updates in Blue Text)
1	Suspect Case Definition	<p>Person with clinical signs and symptoms suggestive of pneumonia or severe respiratory infection with breathlessness AND travel to mainland China within 14 days before onset of illness; OR</p> <p>Person with an acute respiratory illness of any degree of severity who, within 14 days before onset of illness had:</p> <ol style="list-style-type: none"> <li>Been to Hubei Province (including Wuhan city) or Zhejiang Province (including Hangzhou city), China; OR</li> <li>Been to a hospital in mainland China; OR</li> <li>Had close contact<sup>1</sup> with a case of 2019 novel coronavirus infection.</li> <li>Had frequent or close contact during work<sup>2</sup> with recent travellers from mainland China (travel history in the last 14 days).</li> </ol> <p><sup>1</sup> Close contact is defined as:</p> <ul style="list-style-type: none"> <li>Anyone who provided care for the patient, including a health care worker or family member, or who had other similarly close physical contact;</li> <li>Anyone who stayed (e.g. lived with, visited) at the same place as a case.</li> </ul> <p><sup>2</sup> Persons who had close daily interactions with large groups of travellers (i.e. more than 10 travellers) from mainland China.</p>

Routine Instructions – 20 Feb 2020

- Constant review of suspect case definition
  - Higher vigilance enabled us to identify the first case, first cluster, first transport worker
- Staff are constantly engaged and kept abreast of the latest developments via various communication channels
- Celebrate successes together
- Engage and Communicate with Patients and Public



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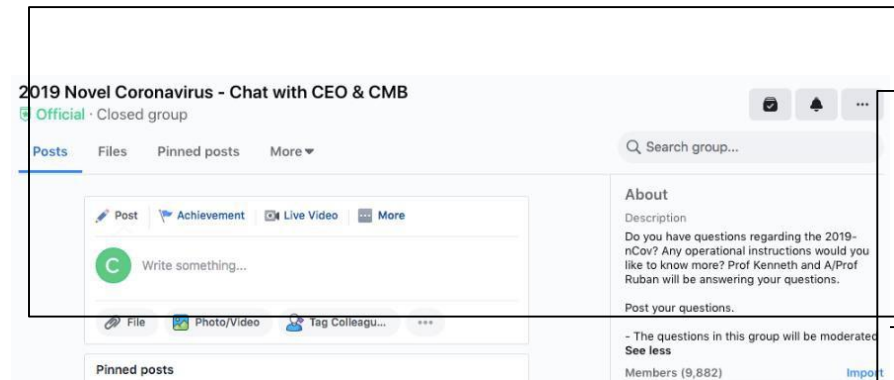
Strictly for internal circulation only Memorandum

2 August 2020

Dear Colleagues

COVID-19 Daily Staff Note 189/2020

CEO CMB COVID-19 Daily Note to Staff



**COVID-19 Webinar**

11 May 2020



**GRAPEVINE Webinar**

**the way forward**

23 July 2020 (Thurs)  
5 - 6pm

Grapevine Webinar is via Zoom. Register by clicking on the link  
Recording of the session will be uploaded on Workplace

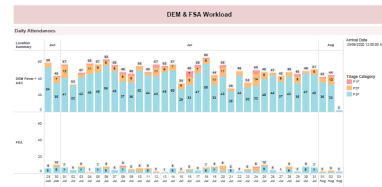


# Innovation: Learning Healthcare System

## Data



*Disease Outbreak Surveillance Dashboard*



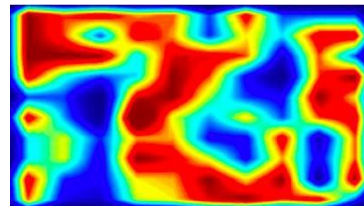
*Thrice Daily Tableau Dashboard – COVID Management Reporting*



*Temi Robot - CCF@Expo*



*DEM Contact Tracing using RTLS*



*Crowd Density Monitoring System (CCTV)*

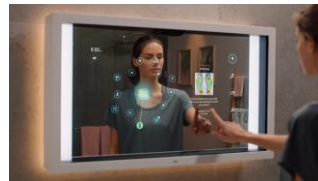
## Technology



*Remote monitoring of Isolation patients*



*MyCare Lite*



*Smart Mirror AI for donning/doffing of PPE*



*UV-C cleaning machines*

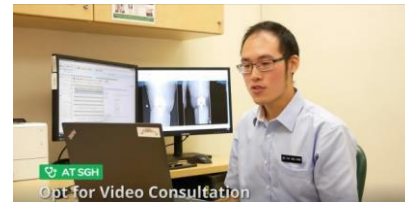
## New Processes



*Reviewing processes at CCF@Expo*



*"just in time" appointments at Specialist Outpatient Clinics*



*Video Consultation Services*



*Electronic Travel Declaration Form*

## New Inventions



*SG SAFE*



*SG SHIELD*



*SG SAFE.R*



*SG INSPIRE*

# Innovation: Rapid Prototyping

## Challenges faced:

- Existing ICUs and OTs are designed as Protective Environments (PE) and are not suited for Infectious Patients
- Severe Shortage of Suitable Airborne Infection Isolation Rooms (AIIRs)
- Aerosol Generating Procedures cannot be performed within normal clinical rooms



Final SG-SPARC model

## Solution: SG-SPARC - System of Portable Ante-Room for Containment

### Features:

- ✓ Powered Interlocking doors
- ✓ Motion sensors
- ✓ Option for Wide opening
- ✓ Emergency override button
- ✓ Hermetically sealed
- ✓ Visible Magnehelic pressure differential gauge x 2
- ✓ Anti-microbial coating (1-year)



Led by Dr Hairil Rizal Abdullah,  
Supported by Dr Tan Zihui,  
Dr Antonia Zeng, Dr Mavis Teo



Design validation

Clinical Validation

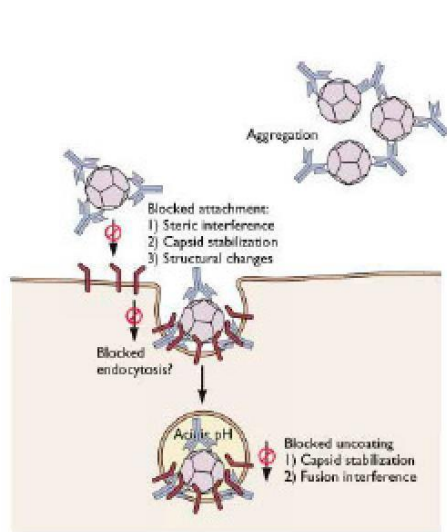
Production Validation

Verification upon  
installation



# Research Innovation & Breakthroughs

## Invention of Serology Tests



## Singapore claims first use of antibody test to track coronavirus infections

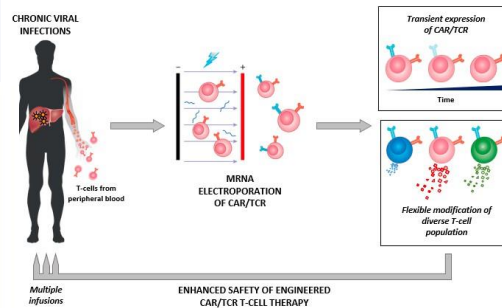
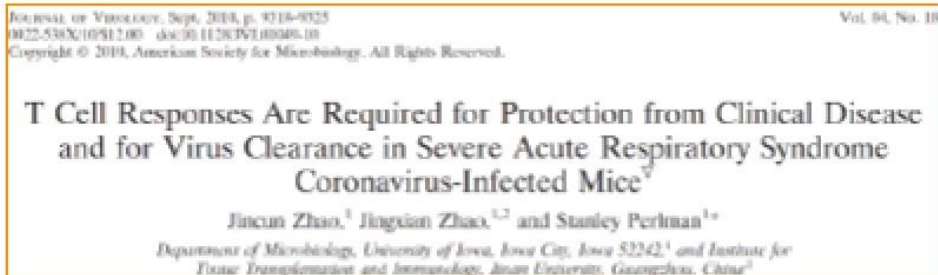
By Dennis Normile | Feb. 27, 2020, 4:30 PM

- ✓ 6 generations (platforms) of serological tests we have developed for COVID-19
- ✓ 4G, 6G (sVNT) to be commercialized
- ✓ Patent filed for sVNT

## Cell Therapy

### Duke-NUS scientists explore using 'own' immune cells to target infectious diseases including COVID-19

• Immunotherapy utilising own immune cells might also be useful in treating other difficult diseases, such as HIV, HBV, beside cancers



## Vaccine Human Clinical Trials



**ST** The Straits Times

### Early-stage coronavirus vaccine trial begins in Singapore

Associate Professor Jenny Low, deputy clinical and scientific director at the SingHealth unit, told The Straits Times yesterday that more than 250 ... 3 days ago

**CTA** Clinical Trials Arena

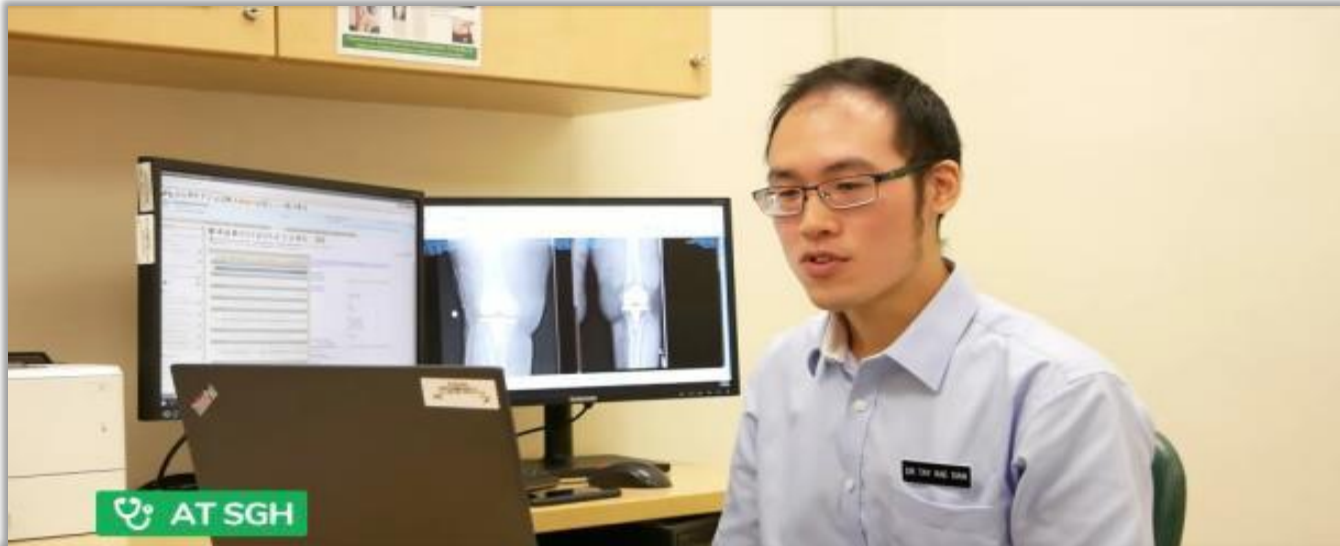
### Arcturus and Duke-NUS to trial Covid-19 vaccine in Singapore

"We are very eager to start the first-in-human clinical trial here in Singapore and advance LUNAR-COV19 on its journey to becoming a potential ... 3 weeks ago





# Accelerating Alternative Models of Patient Care



Video Consultations



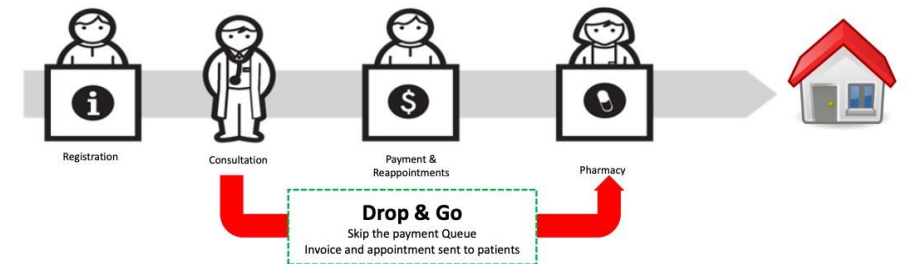
Pharmacists providing tele-consultations for medications



Remote monitoring of vitals via biosensors



Medication Delivery uptake increased from 5% in Jan'20 to 42% in Jul'20



Drop & Go, "Just in time" appointments

# Getting Ready for the New Normal

## (1) Remote Working

Facilitate this major shift, including through technology, infrastructure, performance management etc



## (2) Collaboration and Partnership

Engender a deeper partnership within with other organisations and Individuals



## (3) Adaptability, Innovation and Flexibility

Data Literacy, Tech Savviness, leadership and Accountability at all Levels; Lifelong Learning



## (4) Infection Prevention and Safe Distancing

Physical separation, behaviour of individuals, work processes that facilitate safe distancing



## (5) Staff Engagement, Wellness and Support

Ensure Staff are continually engaged, cared for and feel well taken care of, minimisation of stress and burnout

**Facilitated by Digitalisation and Technology**

Who led the digital transformation of your company?

A) CEO

B) CTO

C) COVID-19

**“As COVID-19 forces organisations to adapt, it also presents opportunities to **innovate**”**





**Thank You**



Singapore  
General Hospital