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THE RACE:

FACE-TO-FACE WITH SARS-COV-2

It was fast and furious. Even the most knowledgeable and experienced infectious experts were baffled and petrified by the virulence of the SARS-like novel coronavirus when it was first reported by the Wuhan Municipal Health Commission on 31 December 2019. Almost two years on, the virus – first known as 2019-nCoV and officially named by WHO as SARS-CoV-2 on 11 February 2020 – has wreaked havoc in almost every continent. Approximately 347 million people have been infected, and more than five million have died due to the COVID-19 disease.[1] In Singapore, the number of COVID-19 infection cases crossed the 300,000 mark, with 846 deaths as of 21 January 2022.[2]

> The key success factor in our outbreak responses lies in our ability to communicate and coordinate hospital-wide operations, based on timely data from across multiple systems and the frontline ■
>
> DR JAMIE MERVYN LIM
> Chief Operating Officer (COO), TTSH & Central Health

Manning the TTSH Operations Command Centre, the nerve of the hospital.

At the entrance of TTSH Emergency Department, in the early days of COVID-19.

THE GENESIS

On 2 January 2020, the Ministry of Health (MOH) swiftly issued a public advisory that it was monitoring closely the cluster of severe pneumonia cases in Wuhan. It also alerted all medical practitioners to be vigilant to look out for suspected cases with pneumonia who had recently returned from Wuhan.

"Frankly, when I first read news of the then-unknown virus coming from Wuhan, China in December 2019, I didn't expect it would eventually explode to become one of the worst pandemics crippling the world as we know today," recalls Dr Eugene Fidelis Soh, Chief Executive Officer (CEO), TTSH & Central Health.

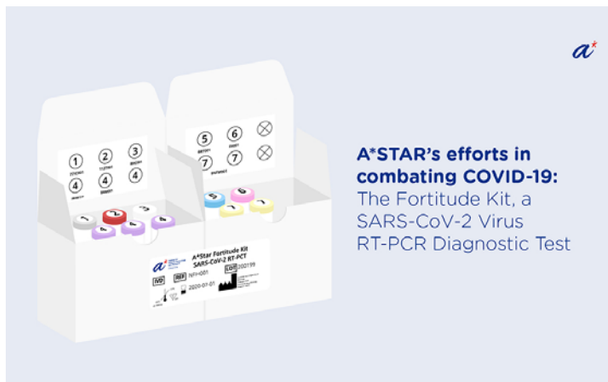
At TTSH-NCID, the vanguard and epicentre of the Singapore's outbreak response efforts, the "battle mode" was activated. On the same day, screening for SARS-CoV-2 began at the Emergency Department (ED) fever screening area. Ten days later, quickly after China uploaded the full genome of the virus on public database, scientists from TTSH and A*STAR[3] started to develop a diagnostic test kit, which served as the first crucial step to managing the outbreak by identifying positive

> "In the beginning, everyone was scrambling to find out what this coronavirus was. It's new, mysterious and dreadfully virulent
>
> DR CHAN YEOW
> Senior Consultant, Anaesthesiology, Intensive Care & Pain Medicine

cases, facilitating tracing and isolation/quarantine, containing spread and administering treatments. In a mere few weeks, 5,000 test kits – the Fortitude 2.0 real-time PCR assay – were made available to 13 Singapore hospitals and labs, public and private. Comprising a pre-packed mix of reagents to test patient samples, which are then fed into a machine that analyses the results, the test procedure saves time by allowing other hospitals and laboratories to conduct their own tests, thus widening the network of facilities able to accurately screen patients for SARS-CoV-2.[4]

Meanwhile, at the national level, on 22 January 2020, the Multi-Ministry Task Force to battle the coronavirus was set up, with then Health Minister Gan Kim Yong (now Trade and Industry Minister) and then National Development Minister Lawrence Wong (now Finance Minister) chairing the high-level Committee. DORSCON level was raised from Green to Yellow. TTSH-NCID, sharing a strong and critical "double bond" of clinical care and operation support, continued to scale up its capacity, capabilities and manpower in anticipation of the fast-escalating number of COVID-19 cases. It was in consideration of Singapore as an international travel hub and overseas Singaporeans and long-term residents returning home.

When ED was first activated on 2 January 2020, TTSH could only hold up to 10 patients for COVID-19 screening, given other Business-As-Usual (BAU) cases. On 24 January 2020, one day after the first case landed in Singapore, on the eve of Chinese New Year, screening was extended to the ED Decontamination



Source: a-star.edu.sg

Inside the Screening Centre at NCID, which opened on 29 January 2020 to meet escalating screening numbers.

(ED Decon) facility with an additional 24 seats. On 29 January 2020, ED's screening numbers for COVID-19 were close to exceeding its capacity. At 8am, the Screening Centre (SC) at NCID was opened up with 20 consultation rooms and 100 seats. Adjunct Associate Professor Ang Hou, Head of ED together with the ED and Emergency Planning (EP) teams led the way in the ramp-up and opening of the SC. Manpower and resources were moved across from ED to SC. Further augmentation by the Division of Surgery, Nursing Service, Allied Health, Operations and Support Staff were assigned for the rapid activation of SC. What was to have been a three-day plan to open upon activation happened within a day. This was only possible because of forward planning and collective efforts.

Fortuitously, just before the massive, hectic ramp up operations, two important landmarks were reached: the official opening of NCID on 7 September 2019, and the commissioning of the TTSH Operations Command Centre (OCC), which featured its new Command, Control and Communications (C3) system in December 2019. C3 provides real-time visibility, flow management and

> At TTSH, we learn that outbreak management at the hospital level has to be nimble; We have to be ready, respond, and recover, only to be ready again

DR EUGENE FIDELIS SOH
CEO, TTSH & Central Health

resource optimisation to enable Hospital Management to coordinate, and make timely and effective decisions.

"The two facilities (NCID and TTSH) have attended to 70 percent of all confirmed and suspected COVID-19 cases on the island. The key success factor in our outbreak responses lies in our ability to communicate and coordinate hospital-wide operations, based on timely data from across multiple systems and the frontline . . . For instance, only two to three people are now needed to monitor over 2,000 beds across both TTSH and NCID, at any given time," Dr Jamie Mervyn Lim, Chief Operating Officer, TTSH & Central Health, tells *GovInsider*.[5]

By the end of Phase 1 and 2 ramp up operations, on 15 March 2020, the total headcount deployed from TTSH to the 687-strong NCID was 1688, including 107 staff seconded from other public health institutions. NCID's total "peacetime" beds of 330 were increased to its "outbreak mode" of 586 beds with ready oxygen points. It was an unprecedented hospital outbreak management response.

When the outbreak worsened after March, some 1475 beds were also operationalised for COVID-19 at TTSH. This was apart from the 729 beds that serve TTSH BAU patients. On 14 April 2020, TTSH opened its first overflow COVID-19 ward back at the main hospital.

On a different front, infectious disease experts were huddling and conferring with their local and international colleagues to study what the novel coronavirus was.

Visitors entering the Screening Centre at NCID.

Beds being moved from TTSH Main Building to NCID as part of Phase 1 and 2 ramp up operations.

RACE TO KNOW THE UNKNOWN "THREAT"

"SARS-CoV-2, the name of the virus that causes COVID-19, had never been seen before.

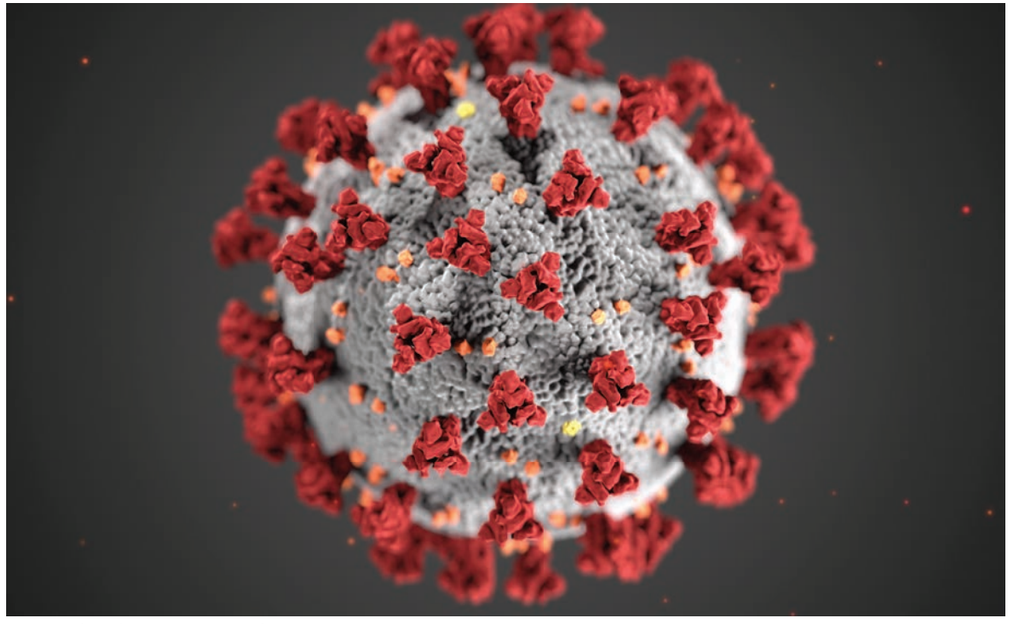
Research was urgently needed to understand how infection could result in short-and long-term damage to the body, how the immune system responded and coped, and how genetic changes in the virus influenced the course of the disease and the epidemic,"[6] writes Prof Leo Yee Sin and Dr Shawn Vasoo, NCID's Executive Director and Clinical Director, in a *ST ScienceTalk* article (5 September, 2020).

It was a race against time.

The earlier the information was pieced together, the better prepared the country, healthcare institutions and various agencies across the island could deal with the pandemic. The COVID-19 battle was on multifronts. With the right information, appropriate resources could be allocated to combat the virus without compromising access to care and treatment of other illnesses. This was aside from formulating extraordinary national strategies and budgets to buttress the economy and social fabric, including ways to protect jobs and ensure the population's well-being, especially in the area of mental health and resilience.

Dr Chan Yeow, Senior Consultant, Anaesthesiology, Intensive Care & Pain Medicine at TTSH recalls, "In the beginning, everyone was scrambling to find out what this coronavirus was. It's new, mysterious and dreadfully virulent. We've a few specialist friends in the region and together we formed WhatsApp groups to discuss its clinical, epidemiological and pathological features and the possible antiviral treatment approaches. We were advised of the national treatment guidelines adopted in China and other therapies explored. In this regard, going forward, perhaps we should consider establishing a network to touch base with our healthcare and medical peers in the East, including those in China, Japan, South Korea and ASEAN – to share information and insights on emerging viruses."

Amid the spate of testing drugs for COVID-19 treatment and community pressure to trial unproven therapies, TTSH-NCID remained steadfast – by following the science and facts. Its engagement with international partners reaped promising results. It was able to conduct and participate in robust trials and was an early adopter of novel therapies such as the antiviral drug remdesivir.[6]



Source: Photo by CDC from Pexels

Inside the NCID Lab.

RESPONDING TO A FAST-EVOLVING SITUATION (EARLY STAGES)

The COVID-19 situation was fluid and fast-evolving in the early stages. From a handful of imported and local cases per day in January 2020 to tens of cases per day in February 2020, the numbers spiked to hundreds and eventually over a thousand per day in April 2020. The latter was largely attributed to outbreaks in migrant workers dormitories. Numbers of COVID-19-related deaths began to climb too. The national response to contain the spread and especially onward spread from the dormitories into the community was swift and firm. Earlier, on 7 February 2020, the DORSCON was raised to Orange, the second highest level of alert, and on 7 April 2020, a "Circuit Breaker", equivalent to a national lockdown, was activated in Singapore.

TTSH swiftly activated "split teams" arrangement as part of its Business Continuity Plan (BCP); mask-up policy was implemented in all staff, clinical and public-fronting areas within the hospital; all dining-in areas were closed in hospital F&B outlets; and safe distancing for staff during meal times. For the public, no casual visitors were allowed to enter the hospital and wards; patients with specific conditions could only register two caregivers with just one allowed in for two

> "It was a tiring and a trying year. I hope that 2021 will allow for us to spend more time in person with family and friends"
>
> DR MUCHELI SHARAVAN SADASIV
> Consultant, NCID

hours per day during visiting hours. The wearing of masks was made mandatory for everyone – staff and visitors alike.

The hospital had to adjust and adopt to the evolving situation as infectious disease experts continued to learn about the virus. With COVID-19 case definitions being tweaked in line with new information of epidemiological links, workflow changes had to be rolled out across the entire healthcare setting. These ranged from initial assessment of patients – such as contact and travel questionnaires – to subsequent downstream chains, including triage, clinical assessment, tests, isolation procedures and so on.[5]

All said, the underlying principle that guides TTSH's response to an unknown "enemy" is agility.

"At TTSH, we learn that outbreak management at the hospital level has to be nimble; to quickly take on various postures and effectively tackle the fast-evolving situation, in tandem with public health efforts at each phase of the outbreak. We have to be ready, respond, and recover, only to be ready again," states Dr Soh.

TWO YEARS ON . . .

Close to two years on, COVID-19 continues to wreak havoc across the globe. Economies are battered and poverty rates are rising in countries rich and poor. But there are a few silver linings.

As of 25 February 2021, there were more than 70 COVID-19 vaccine candidates in human trials, with several

Temperature check at every entrance.

The roll out of vaccination began in earnest starting 30 December 2020, with the first shot adminstered to Senior Nurse Sara Lim of NCID (bottom left).

vaccines approved and being administered in some countries.[7] On 8 December 2020, a 90-year-old British grandmother became the first person in the world to be given the Pfizer COVID-19 jab as part of a mass vaccination programme in the UK.[8] Other vaccines that have so far been approved for use include those manufactured by Moderna and Oxford/AstraZeneca. WHO, on 1 January 2021 and 15 February 2021 respectively, approved Pfizer/BioNTech and Oxford/AstraZeneca vaccines in a breakthrough for developing nations. This was swiftly followed by WHO approvals of Janssen (12 March), Moderna (30 April), SinoPharm (7 May) and Sinovac (1 June).[9]

On 14 December 2020, the Multi-Ministry Task Force outlined plans to enable Singaporeans to get vaccinated against COVID-19, in its efforts to facilitate the country's economy to open up and more social activities to resume.[10] On the same day, the Pfizer/BioNTech COVID-19 vaccine became the first vaccine to receive approval from the Health Sciences Authority (HSA) for use in Singapore.[11] On 3 February 2021, the Moderna COVID-19 vaccine was approved.[12] Senior staff nurse Sarah Lim of NCID became the first person in Singapore to receive a COVID-19 vaccination on 30 December 2020, together with her frontline healthcare colleagues, totalling 40.[13] Since then, TTSH-NCID frontline health workers have been inoculated in batches.

Nonetheless, the battle against COVID-19 continues to be an uphill one. There has been an emergence of multiple SARS-CoV-2 variants of concern (VOCs) since its original strain surfaced in December 2019. These include Alpha (B.1.1.7), Beta (B.1.351), Gamma(P.1) and Delta (B.1.617.2), appearing in December 2020 and January 2021. The dominance of the Delta variant in September 2021 is now being superseded by the highly infectious new variant, Omicron.[14]

On 23 January 2021, one year after the first COVID-19 case landed in Singapore, TTSH marked the day with an exhibition "Stronger Together, Better Together" to recognise and honour the brave frontline workers, showcasing artworks, handicrafts and messages of gratitude and encouragement from the community.

Reflecting, Dr Mucheli Sharavan Sadasiv, Consultant, NCID, shares, "It was a tiring and a trying year. In retrospect, it has been a humbling experience; and a lesson in embracing uncertainty and knowing our limitations. I hope that 2021 will allow for us to spend more time in person with family and friends. And that we remain healthy, both physically and mentally."[15]

Kenneth Neo, Staff Nurse, Ward 6B, adds, "2020 was a year of many adversities – from converting our ward into an outbreak ward, to donning full PPE, to nursing patients with COVID-19. It is quite like my National Service days, comparably challenging to overcome, but still, we all made it to 2021 . . . I'm hoping for the very day my colleagues can finally tell their families back in the Philippines, China, Taiwan, and Malaysia, 'I'm coming home!'"

In the end, no one should let his or her guard down, even with comprehensive vaccination coverage in the population. It is not a silver bullet. The journey towards "normalcy" remains precarious. The fight goes on. ■

Marking the first anniversary of the COVID-19 fight with two exhibitions at TTSH Atrium.

1 HOSPITAL. 2 MISSIONS:

GETTING READY FOR THE BATTLE

One hospital. Two missions. It is a rare mandate for any hospital: to fight the COVID-19 pandemic while serving Business-As-Usual (BAU) patients in the Central Region of Singapore.

A grand dame at 177 years since its inception, TTSH is an acute hospital that serves over 1.4 million residents in central Singapore, the island state's most populated zone. The hospital – then called "Chinese Pauper Hospital" – has been the epicentre of numerous outbreaks since its foundation stone was laid on Pearl's Hill.

Fast forward to today: as one of the largest multi-disciplinary hospitals in Singapore, TTSH operates more than 1,700 beds with centres of

> "Some of our colleagues have been deployed (to the frontline), but our ward sisters have been stepping up to do more clinical work, so it's really all hands on deck to ensure our patients still receive good care ■
>
> BINAYAN JENNIFER BOADO
> Senior Staff Nurse, Ward 9D

Drills began in earnest to guide frontline staff on how to properly don PPE.

Myriad initiatives and efforts to scale up hospital outbreak management capabilities.

excellence set in the new HealthCity Novena campus. These include the National Centre for Infectious Diseases (NCID) – the vanguard institution tasked to combat COVID-19, the National Skin Centre and the National Neuroscience Institute, among others. The hospital, as a healthcare leader in population health, systems innovation, health technologies and workforce transformation, also hosts Singapore's largest purpose-built innovation centre for healthcare: the Ng Teng Fong Centre for Healthcare Innovation (CHI) and its Co-Learning Network of 37 local and international partners.[1]

COVID-19 presented TTSH and NCID – known as the "double bond" – a most gruelling, daunting challenge: it tested its "response", "recovery" and "readiness" modes for outbreaks. It was no walk in the park.

GETTING READY

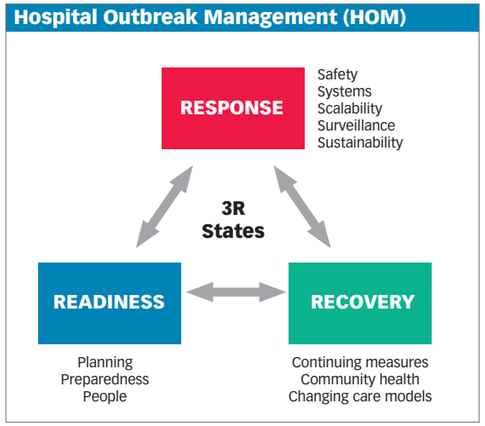
SARS left a lasting impression on Singapore, and on her outbreak epicentre, TTSH. In 2003, TTSH became the designated hospital for SARS; all non-SARS patients were sent elsewhere.

Things were different with COVID-19.

While NCID – purpose-built to be the nation's outbreak first response institution – was up and running just a few months (its official opening was on 7 September 2019) before the first COVID-19 case struck Singapore on 23 January 2020, TTSH had to maintain operations for day-to-day BAU patients, and at the same time, scale up its capacity and capability to care for an overflow of COVID-19 patients arriving at NCID.

"Unlike SARS in 2003, when TTSH essentially focused on dealing with the outbreak, this time, we had to contend with treating COVID-19 patients as well as treating our non-COVID-19 patients, or BAU patients. We needed ingenuity, resolve and unity to do so," Dr Michael Chia Yih Chong, Senior Consultant, Emergency Medicine shares.

"At TTSH, we learn that outbreak management at the hospital level has to be nimbler, to quickly take on various postures and effectively tackle fast-evolving situations, in tandem with public health efforts at each phase of the outbreak,"[2] CEO Dr Eugene Soh tells *The Business Times*.



> There is no drama, social alienation. Everybody is just so united

JAMES ANG WEI KIAT
Senior Nurse Manager

To be ready for any major outbreak, TTSH has to apply agility and speed in its response, as well as scalability in terms of capacity, capability and manpower. All of this is encapsulated in the Hospital Outbreak Management (HOM). Apart from the main "S", scalability – that is, to switch from "peacetime" mode to "outbreak" mode in as short a time as possible – HOM features four other crucial "S"es:

- *Safety*: To protect TTSH staff so they can protect each other and their families, and keep patients safe. Embraced as a "culture" and achieved by "design", the hospital emphasises strong infection control and prevention, ranging from rudimentary practices such as hand-washing and wearing appropriate Personal Protective Equipment (PPE) for each role and location, to facilities-planning for the segregation of staff and patient flows, and clean and dirty flows.

- *Systems*: It's about adopting a systems approach to thinking of what it takes to effectively manage an outbreak, and at the same time fulfil the BAU mission well. TTSH's C3 – Command, Control and Communications System – commissioned in December 2019 at its Operations Command Centre (OCC), provides real-time visibility of patient flow and resource management. Touted as a "game changer", it has the *ability* and *agility* to scale an outbreak response from a single hospital to a national strategy across hospitals.

- *Surveillance*: TTSH has to exercise vigilance 24/7 amid COVID-19, and any other outbreak. It needs to keep an eye on the front door of the virus (cases), as well as the back door, as the risk of hospital staff or/and BAU patients bringing in the infection from the community is all too real. The hospital's Department of Clinical Epidemiology is assigned to oversee surveillance. Technologies used range from the simple to the sophisticated: from Staff Roll Calls to Real-time Location Tracking Systems (RTLS); from Closed Circuit Televisions (CCTVs) to Video Analytics.

- *Sustainability*: To last and win a battle, and prepare for the next battle, the hospital needs to consider how to optimally man its operations, both outbreak and BAU. It must plan so as not to exhaust its workforce before the battle ends. Measures rolled out include reduction of non-essential activities, management of staff leave, redesign of jobs and redeployment of staff. Special attention is given to building mental resilience of staff, via communications platforms (intranet and dedicated Workplace from Meta page), constant messages, success/inspiration stories and staff-support-staff (3S) initiatives.

TTSH's battle plan is certainly not foolproof. It requires periodic assessment and tweaks to stay ahead of the operations needs curve.

Briefing amid conversion of Level 7 Ward in preparation to receive COVID-19 patients.

ALL HANDS ON DECK

TTSH's manpower and resources are fixed, hence the challenge to stay effective grew exponentially when the hospital was faced with having to meet the specific, urgent needs of COVID-19 patients as well as the ongoing needs of BAU patients, especially those with critical conditions. Improvisation became a necessary skill so that the hospital staff could ensure every patient got the care he or she needed. It was an exhausting endeavour, but a rewarding one when patients were finally discharged.

Fighting a two-front battle requires a collective mindset shift for a collective mission – it eschews "whose job is this" for "how can we do this job together"? At the heart of it, the staff of TTSH possesses absolute conviction of who they are and why they do what they do. No individualism; only collectivism for the greater good of delivering better care to patients. This undergirds TTSH's culture of excellence, the nexus that binds the hospital's *kampung* spirit.

This team spirit revealed itself daily in different situations: from the hospital ramping up operations to converting the inpatient wards into COVID-19 wards at

Conversion of Level 9 Ward into a COVID-19 Ward.

Frontline staff working round the clock, conducting swab tests at the Screening Centre at NCID.

TTSH Levels 7 and 11, to standing in the gap and pulling double duty when the Screening Centre (SC) faced an overflow of patients day after day. It was no easy task – 10,000 staff from diverse backgrounds pulling together, bonded in crisis.

Laura Ho Pei Wah, Deputy Director of Nursing, adds, "I believe in team work, not just within our department but across the hospital. We are strong as individuals but even stronger together as a team. Through COVID-19, we realised that our colleagues are always ever-ready to come in to help; with one goal in mind – for the care of our patients."[3]

Agreeing, James Ang Wei Kiat, Senior Nurse Manager, who was deployed at the SC at NCID, says in *CEO Tribune*, "Everyone at SC comes from varying hierarchies of different departments; I've never experienced such a high level of teamwork. When you're in a crisis, you fight together. There is no drama, social alienation. Everybody is just so united."[4]

With all hands and hearts on deck, TTSH managed to run its COVID-19 and BAU operations concurrently, even when it entailed stepping out of standard roles to serve entirely different ones. This support from each other bound the

TTSH staff continues to reach out to the needs in the community, even amid COVID-19.

hospital staff closely together, giving them strength to remain resilient.

Indeed, taking on two missions at a hospital is not simply about getting ready the necessary *hardware* of capacity and capabilities, it's also about the *heartware* of respect and consideration for each other, and having the humility and sacrificial posture to work as one.

HOSPITAL WITHOUT WALLS

The "DNA" – *raison d'être* or reason to be – of TTSH has always been about building a community of care by the community it serves. It has not diverted from this core vision even as it has evolved from a "hospital for paupers" to a major tertiary hospital today. This DNA remains steadfastly the same (albeit expressed in a new language for a new era): to create an integrated community of healthcare, medical education and translational research in a vibrant and sustainable communal environment.

"Hospital without Walls" expresses a transformative concept and the singular pursuit of TTSH to leverage on its network of community partners to manage the fast-evolving and unpredictable nature of COVID-19, especially the surge in patient numbers.

> "It's very heartening that everyone has stepped up during this time"
>
> DR GREGORY KAW JON LENG
> Head of Diagnostic Radiology

First, NCID, which is linked to TTSH Main Building Emergency Department (ED) via a double-storey skybridge, serves as a major node that provides the first, swift response to any outbreak in Singapore, while TTSH serves as its "big sister" to provide the necessary, scalable resources – be it equipment, supplies or manpower – without compromising treatment of BAU patients, especially those with critical conditions.

Next, TTSH has built an integrated care network in the community. These community care facilities comprise community hospitals like Ren Ci Community Hospital (RCCH) and Ang Mo Kio-Thye Hua Kwan Community Hospital (AMK-THK), which partnered TTSH to receive long-term TTSH patients (including recovering COVID-19 patients), freeing up beds for COVID-19 patients and BAU patients with critical conditions. Other care facilities include the old Communicable Diseases Centre (CDC) which was recommissioned as an isolation/care facility for migrant workers waiting for their COVID-19 test results.

All of this evidences a thriving community care partnership.

What is needed is the development of Standard Operating Procedures (SOPs) and protocols to effectively and efficiently care for patients of differing medical conditions. It is about shifting care beyond the four walls of the hospital into the community. This allows the cultivation of longer-term relationships with patients. Post-COVID-19, TTSH will reinforce its efforts to build a strong community of care with its partners to better look after not only patients who come through its doors but also serve the population that lives within its catchment area.

All hands on deck as the number of beds are scaled up at NCID.

Meeting BAU patients' needs remains key even amid COVID-19. Seen here are allied health professionals assisting BAU patients.

The quest to build a "Hospital without Walls" means the need for digital health and health information systems. Shifts to telehealth and online order for home delivery of medications are being accelerated by the safe management measures during the outbreak. Meanwhile, the adoption of advanced health information systems is essential in managing patients' medical records and facilitating medical consultation across different care facilities.

READYING CAPACITY FOR COVID-19 AND BAU PATIENTS

To fulfil TTSH's twin missions, rationing of resources takes top priority. On 28 January 2020, when COVID-19 cases started to flow in, the hospital kicked off its augmentation for outbreak response. This meant it had to reduce its BAU operations to avail manpower and resources to fight the outbreak. Very quickly, arrangements were made to triage clinic appointments and postpone elective and non-urgent cases. Within 24 hours, TTSH ED had transferred COVID-19 screening operations to the SC at NCID, and 1,266 staff were transferred from the main hospital to augment the 687-strong NCID, ramping up NCID's capacity and keeping SC open 24/7. A subsequent addition of 422 staff were deployed to

NCID, including 107 seconded from other public health institutions.

At the first peak of COVID-19, in mid May 2020, TTSH continued to operate 729 BAU beds, as well as some 1,475 beds already operationalised for COVID-19 patients across its campus. This was on top of NCID's scaled up 586 beds for COVID-19 patients, from its original "peacetime" count of 330 beds.

TTSH's agility and speed in activating and scaling up resources and manpower to meet the escalating needs of COVID-19 cases while rationing resources for BAU wards enabled the hospital to continue its BAU work. It would not have been possible without selfless acts on the part of the staff.

The Department of Diagnostic Radiology was a good example. The large screening numbers at NCID created a manpower shortage, but it was alleviated by doctors from the department chipping in to help on the frontline, on top of serving BAU patients.

"It's very heartening that everyone has stepped up during this time," observes Dr Gregory Kaw Jon Leng, Head of Diagnostic Radiology.

Similarly, the Speech Therapy Department deployed some staff to SC, with a number on standby to serve at NCID. This meant that the remaining Speech Therapists had to cover for colleagues on the frontline.

Senior Speech Therapist Florence Tang Mei Ai shares, "Even with the new workflows and teams, staff morale has certainly not been dampened during this tough time and departments are supporting those in the frontlines however they can, however small it may seem."

It was equal sacrifice from all TTSH staff – frontline or backline – to protect patient well-being, staff safety and the safety and security of every person in the hospital.

A speech therapist serving as an augmented staff managing entrance screening.

> TTSH will require a whole-of-hospital effort under a collective leadership, working collaboratively with external partners, for the good of the larger community and population

ASSOC PROF CHIN JING JIH
Chairman, Medical Board, TTSH & Central Health

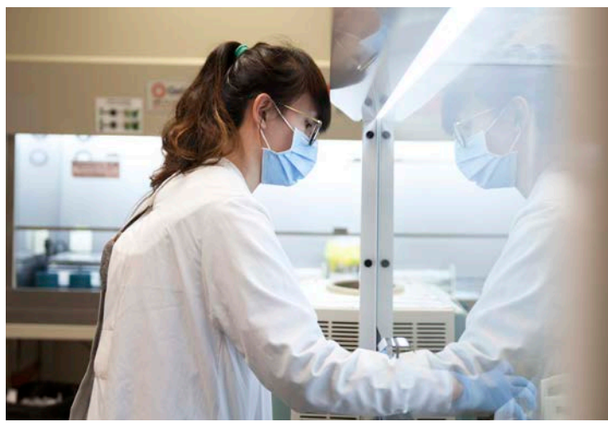
THE TWIN-MISSION WARRIORS

"Some of our colleagues have been deployed, but our ward sisters have been stepping up to do more clinical work, so it's really all hands on deck to ensure our patients still receive good care," remembers Senior Staff Nurse Binayan Jennifer Boado. At Ward 9D where she works, two members of the staff were deployed to the frontlines in March 2020, and on days when there were many new cases, up to 30 percent of manpower would be cut from the non-COVID-19 ward.

One department that had to handle twin missions was the Department of Laboratory Medicine. Its Head, Dr Partha De, explains, "While COVID-19 testing was a priority, the lab did not stop its work on other non-COVID-19 cases. Tests such as haematology, MERS and Avian Flu still had to be run. In addition, the team also had to support COVID-19 pneumonia screening and COVID-19 testing from NHG Polyclinics, IMH and Community Hospitals."

The lab at TTSH and the one at NCID operate 24/7, given the increasing demand for COVID-19 testing, which also meant that additional staff had to be recruited and trained to run a PCR test, where many steps are involved, taking up to eight hours for results (more details in Chapter 9).

Despite the non-stop work and high stress levels, enduring daily changes to work processes and rosters, the department staff remained positive



A lab technician working at the TTSH Lab.

> At the end of the day, we knew we needed a collective mission to see us through the challenge of a twin-mission hospital

DR EUGENE FIDELIS SOH
CEO, TTSH & Central Health

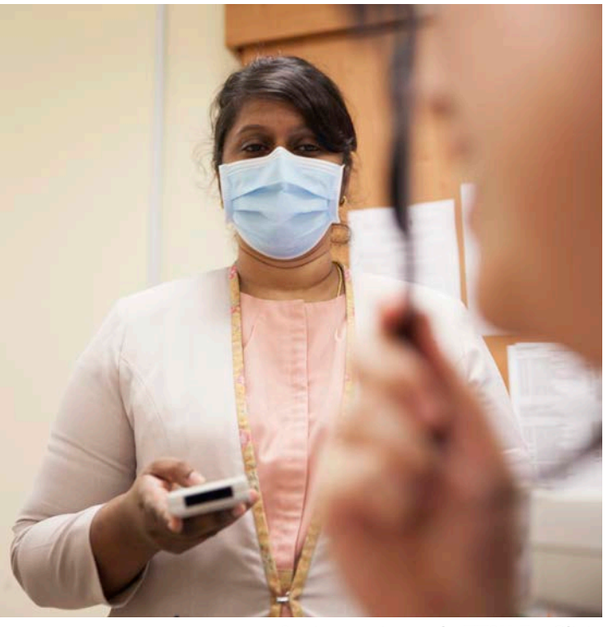
and put in their best efforts to help one another.

TTSH's Eye Department postponed 70 percent of its elective surgeries at the end of January 2020 so that its staff could be deployed to the frontline. However the Department was as busy as ever, if not more, as urgent cases that could not be postponed still needed to be treated, and to reschedule non-urgent cases was a monumental task as well. It took all the parties involved – the nurses, allied health team, administration and other staff – to pull together and keep the department going.

"It's like a family, we help and keep a look out for one another," Winnie Koh Meixiang, Assistant Director of Ops (Eye) shares. "There is a strong sense of camaraderie that we are all in this together."

These are but just a few of the many departments within TTSH that have fulfilled their twin missions, armed with a sense of purpose and camaraderie.

Assoc Prof Chin Jing Jih, Chairman Medical Board, TTSH & Central Health observes, "To adeptly juggle both the heavy burden of routine clinical services, and preparedness for major civil emergencies and disease outbreaks, TTSH will require a whole-of-hospital effort under a collective leadership, working collaboratively with external partners, for the good of the larger community and population."



Serving a patient at the TTSH Eye Clinic.

At the Ward Registration Counters area, where strict safe management measures will be in place for the foreseeable future.

LIVING WITH A NEW NORM

When NCID was officially opened on 7 September 2019, it was hoped that TTSH would never have to use it for a major outbreak. There was even concern that it would be a white elephant, but just months later, that was put to rest when NCID proved to be immensely valuable in fighting the COVID-19 outbreak.

COVID-19 has ushered in a "new normal" in healthcare. One hospital may have two or even more missions, as demonstrated by TTSH. As then Health Minister Gan Kim Yong said in his interview with *The Straits Times*, "Hospitals here must be designed with flexibility in mind so they can adapt to changing healthcare needs in future … Changing demographics and disease patterns will require a changing model of care. It is important that hospitals are able to be flexible and adjust to these new care models where necessary."[5]

"At the end of the day, we knew we needed a collective mission to see us through the challenge of a twin-mission hospital,"[6] concludes Dr Soh.

KAMPUNG SPIRIT TO THE FORE

TTSH'S CARE JOURNEY: AN INTRO

In 1844, TTSH was the first hospital to be started by the community for the community. Tan Tock Seng was a roadside grocer from Malacca, who became a businessman with a shop in Boat Quay. He became an influential Chinese leader and was made a Justice of Peace by the British government. There being no proper medical facilities for the common people at that time, Tan Tock Seng donated 7,000 Spanish Dollars to build what was initially called the "Chinese Pauper Hospital", which he said was to care for not only the Chinese but the "sick poor of all nations".

Since its inception, TTSH has lived up to its founder's vision of being a hospital for the people. For more than 177 years, it has risen up to serve the nation in bringing professional care, seasoned with compassion, to the sick. From being the first hospital in the world to discover a treatment for Beri Beri to setting up the Tubercolosis Clinic in the 1960s, which found a successful protocol for treating TB, TTSH has consistently served the people through the hard work and teamwork of its dedicated staff, generation after generation.

From fighting the Spanish Flu in 1918 and the influenza pandemic in 1957, TTSH's role as an outbreak hospital was cemented in 2003 when SARS happened. On 22 March 2003, TTSH was declared the dedicated SARS hospital for Singapore.[7] All SARS cases were isolated there, and positive cases in all other hospitals in Singapore were transferred to TTSH. When the H1N1 pandemic happened in 2009, TTSH's emergency department was the designated centre.

The kampung spirit at TTSH is keeping the staff motivated and hopeful.

WE CARRY THE 'KAMPUNG SPIRIT' BADGE

"The *kampung* spirit is this certain sense of working in this hospital: you need a common purpose, you need a language, you need relationships. I don't think anyone joins Tan Tock Seng Hospital because they want to work in healthcare. I think we are in healthcare because we believe in the mission we have. I believe people join TTSH knowing that one day they will stand on the frontline of an outbreak response," says CEO Dr Eugene Soh.

COVID-19 has brought to the fore that inherent *kampung* spirit that has always been part of TTSH's DNA – every member of the staff displays the same response to a crisis situation, all departments pull together naturally, setting aside differences to fight a common foe.

"I'm fortunate to have experienced working in different departments over the years. One characteristic that TTSH distinguishes itself from others is that it emits the *kampung* spirit, the air of togetherness. This makes even the most difficult day to manage, easy to pass. Just glad to be part of the big TTSH family," Charmaine Loh Hui Wen, Assistant Nurse Clinician, Clinical Instructors, shares.

BECOMING

Through the thick of battling on the frontline shoulder to shoulder with her colleagues, Babasa Kristel Ann Gallenito, Senior Staff Nurse II from Rehab Wards, discovered a new sense of self. "Before being deployed to NCID, I was happy-go-lucky," she says. "But being on the frontline was a great responsibility, and I knew I needed to do a good job. And I did it. This deployment changed me a lot – I was able to showcase my capabilities. I learnt to appreciate everything, respect everyone. I learnt, working in NCID that we mustn't be aloof, we must be accepting of each other."

At the end of her deployment, Kristel shot a video of her colleagues, commemorating the time, the challenges, the laughs they shared together, overcoming the serious outbreak in May 2020 and finally, closing the ward. "We did it!" she smiles. "It's a story I can tell my grandchildren." ■

UNDIVIDED:

LEADING IN THE HOUR OF DARKNESS

> We learnt a lot from SARS, so our response is one of preparedness. We are constantly anticipating situations that may materialise and actively taking steps to be ready ■
>
> DR HOI SHU YIN
> Chief Nurse, TTSH & Central Health

From the first COVID-19 case that landed in Singapore on 23 January 2020 to the first administration of vaccination on 30 December 2020 and the ongoing battle, COVID-19 is not simply a test of the hospital's outbreak response capability, but its leadership in the hour of darkness, from the ground to the highest level. From the medical and nursing team fighting in the first line of defence at the Screening Centre, to the "battle planning room" led by the chiefs of the hospital and various departments, the test is gruelling, unrelenting.

It is a test of unity, common intent, and most of all, sacrifice for the greater good.

A team of resuscitation nurses working at the Emergency Department.

"How're you feeling? It's going to be alright, don't be afraid. Hang in there. We'll get through this together." These common phrases the leaders used on the ground – to assure their team members – might sound "ordinary", but they brought infinite hope. The words gave them confidence and motivation in a journey of seemingly unending stress, desperation and disappointment, with rising cases and deaths, especially at the start of the COVID-19 outbreak.

While in any crisis the test of top leadership is often emphasised, in the TTSH *kampung*, the middle managers are spotlighted. "The most important leadership is the middle managers; if the ground staff can each say with conviction, 'this is not just a job', we would have succeeded as leaders," affirms Dr Eugene Soh, CEO, TTSH & Central Health.

LEADING IN THE DARK HOUR

Nevertheless, in the face of the once-in-a-generation pandemic crisis, it calls for extraordinary leadership that permeates every echelon of the hospital. Everyone will have to share a common vision, clarity and language.

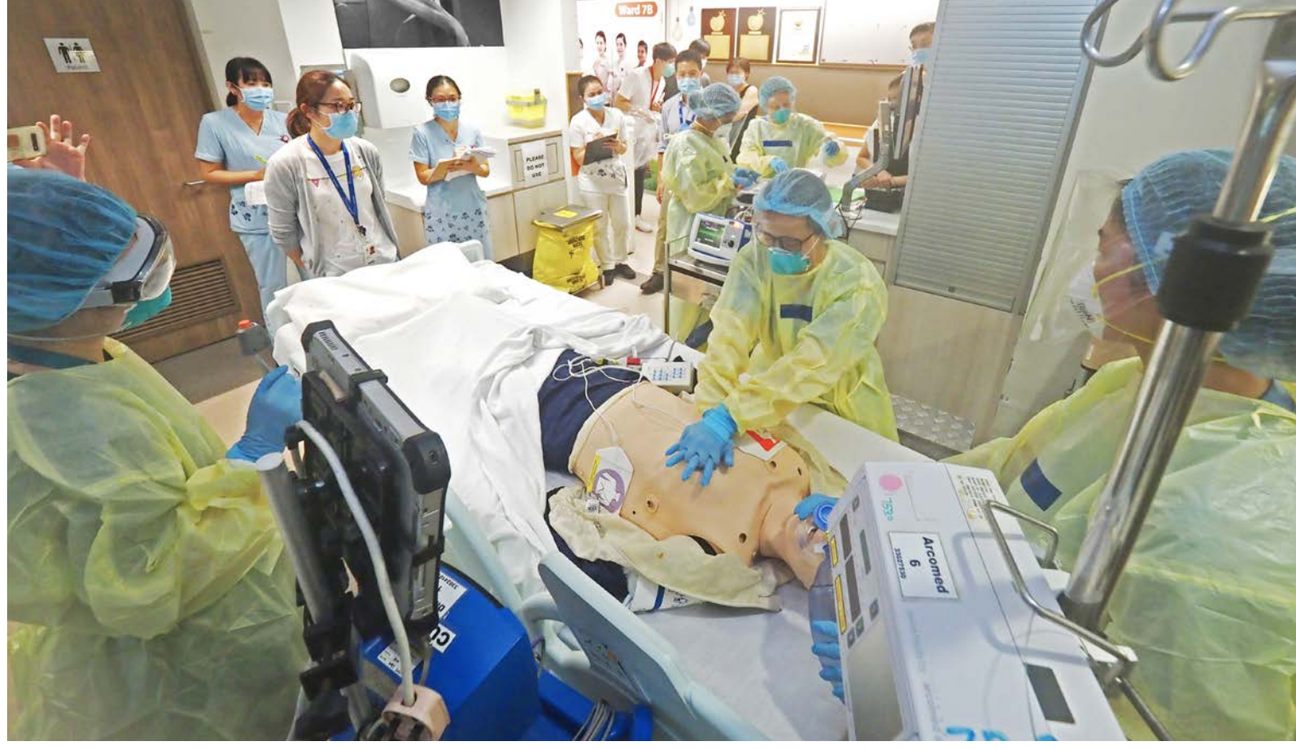
For some, COVID-19 brings back memories of SARS, the last major outbreak in Singapore; but at the same time, it summons the courage to fight gallantly.

Kalaichelvi D/O G Govindaraju, Senior Nurse Manager at Level 7 Wards never thought she would face another major outbreak – significantly more serious this time – after facing SARS in 2003. She was unfazed nevertheless. "I'd never have thought that I would experience another major virus outbreak so soon after the SARS outbreak. I must admit the sadness of seeing patients and colleagues suffer and die, including two TTSH colleagues, from SARS still lingers. Yes, the dark hour of COVID-19 has arrived. But we must not lose hope. We had prevailed from SARS. We will also prevail alright this time."

She adds, "I'm truly encouraged that as we huddled as a compact team at Level 7 Wards to care for the patients and for each other, no one actually applied for MC, and all were prepared to work longer hours! Some even came back to help, even though they were not scheduled for duty. It was remarkable."

For Dr Hoi Shu Yin, when SARS broke out in Singapore in 2003, she was then a frontline nurse at TTSH. She saw the uncertainties and damage it caused. Now the Chief Nurse, she

Staff transporting a "dummy COVID-19" patient for treatment, as part of the drills conducted at the COVID-19-converted Level 7 Ward.



Drills at Level 7 intensified as ward staff prepared for an increased caseload of chronically ill COVID-19 patients.

> No one actually applied for MC, and all were prepared to work longer hours! Some even came back to help, even though they were not scheduled for duty. It was remarkable ■

KALAICHELVI D/O G GOVINDARAJU
Senior Nurse Manager

used all her SARS experience to get the hospital ready to cope with the surge in patients. She tells *The Straits Times (ST)*, "We learnt a lot from SARS, so our response is one of preparedness. We are constantly anticipating situations that may materialise and actively taking steps to be ready."[1]

She adds, "Nurses are in charge of the wards, so we have to make sure they are equipped with the right facilities to take care of the patients and ensure their safety. We also have to ensure the environment is set up to keep our staff safe."[1]

Across the hospital's main building, linked by the double-storey skybridge, is NCID, the vanguard of Singapore's battle against infectious diseases. Less than four months after its official opening on 7 September 2019, it was plunged into combating a global pandemic. It was akin to a baptism of fire. Led by Prof Leo Yee Sin, a veteran in managing outbreaks – from 1999 Nipah, 2003 SARS to 2009 pandemic influenza and multiple surges of vector-borne diseases, including the Zika outbreak in 2016 – COVID-19 still surprises her. In her *Straits Times* article (*ST ScienceTalk*) written with NCID Clinical Director Dr Shawn Vasoo, she observes, "We would soon learn that this was a very unusual virus, one full of surprises. We had to watch it closely as we learnt to deal with it every step of the way . . . We have fought back with three weapons: *knowledge*, *flexibility* and *collaboration*."[2]

On the first anniversary of NCID's opening, in her interview with ST,[3] she remarks, "It was a surprising first year full of challenges. COVID-19 arrived barely four months after our official opening. The magnitude and speed of its spread were unprecedented. We had to ramp up the entire facility beyond the original design of 330 beds to more than 500 beds at one point during the pandemic."

Amid the evolving knowledge of how COVID-19 behaved and its impact, a ready reserve of preparedness, level-headedness and foresight guided

Lab technician carrying out sample test at the TTSH Lab.

the national and hospital response. Once adequate epidemiological and clinical evidence was established, recommendations were swiftly drawn up to formulate prevention strategies such as early testing and isolation and treatment approaches using novel therapies, including the antiviral drug remdesivir and convalescent plasma, which was used before other therapies – e.g. steroids – became more established.

Dr Vasoo adds in the same ST article, "As at end July, more than 500 COVID-19 patients have been recruited for NCID's longitudinal 'PROTECT' study, which detects novel pathogens and characterises emerging infections … allowing us to study the impact of the virus from multiple angles, from disease manifestations and viral shedding to immune response. What we learnt from these patients provided the foundation for developing diagnostics and testing strategies, and modelling disease and transmission patterns . . . This was critical evidence which guided prevention strategies such as early testing and isolation policies."[2]

Lab technicians sorting out labels of names of samples collected.

CONFRONTING FAILURE

In the hour of darkness, leadership is also tested when confronting a failure of significant scale.

The news headline reads, "Jurong West Secondary student wrongly diagnosed with COVID-19, TTSH says it made a mistake."[4]

It was one of the lowest points in TTSH's fight against the coronavirus. The hospital admitted on 14 July 2020 that its laboratory had mislabelled two samples, which led to a student being wrongly diagnosed with COVID-19. The Secondary 1 female student – presumably would have been Case 45655 – was from Jurong West Secondary School. She was reported on 14 July 2020 to have tested positive for coronavirus. She was swabbed because she had been in contact with a 13-year-old schoolmate, who was previously confirmed to be infected. The mislabelled positive sample belonged to a migrant worker. In a statement, TTSH apologised for the mislabelling:

"We are sorry for the mistake and sincerely regret the inconvenience caused to our patients and the school," it acknowledged. "We have audited our laboratory testing for COVID-19 for that period and no other mislabelling was discovered. We have also put in place additional checks to prevent such an incident from occurring again."

Commenting on the mislabelling error, Dr Partha De, Head of Laboratory Medicine, says, "This is a terrible mistake. It's a consequence of a lot of manual steps and fast-escalating test loads. Despite our best efforts to ensure error-free labelling (on samples), we failed. We have to learn the lesson, pick ourselves up and do better. I remember CEO visited the lab to confer with us how best to support the lab and its process so we don't make such a mistake again. He didn't say much about the episode. He didn't scold us."

Dr Partha continues, "This is true leadership. CEO (Dr Eugene Soh) and the Group CEO (Prof Philip Choo) were fiercely focussed on pre-eminent issues, and not on 'blaming anybody'. Indeed, I've learnt much as I observed them in the first few months of the outbreak.

> "This is a terrible mistake. It's a consequence of a lot of manual steps and fast-escalating test loads . . . This is true leadership. CEO and the Group CEO were fiercely focussed on pre-eminent issues, and not on 'blaming anybody' ■
>
> DR PARTHA DE
> Head of Laboratory Medicine

Everyday at 9am without fail, there would be meetings with the various HODs. Sometimes, these meetings would stretch for four or five hours straight. But they would sit there, without taking a break. The calmness and authority I saw in them amid all the pressure . . . that was inspiring . . . they don't complain, they just get on with it. So who am I to complain?

"For me, I just need my coffee; I just couldn't survive without my second cup."

Samples are stacked carefully on each test tube rack.

> I saw how my leaders fought alongside us at the Screening Centre in full PPE, working doggedly in uncomfortable environments ■
>
> GENEVIEVE LIEW QIAN WEI
> Senior Radiographer, Radiography Service

Staff from various departments of TTSH-NCID working as a team to administer swab tests at the SC extension at NCID.

WHAT TRULY MATTERS

TTSH has invested in a leadership and organisational development framework that is anchored in collective leadership across the hospital and with community partners. At the *individual* level, it focuses on engagement tools to build relationships. At the *team* level, it looks into tools to enhance teamwork. And at the *organisational* level, it develops networking tools to enable staff to work across teams and organisations to build partnerships. It sees this as the essence of a future-ready organisation that can also respond in times of crisis.[5]

Three core engines fuel TTSH's collective leadership: common purpose, language and relationships. Nonetheless, in the end, it's all about people.

CEO Dr Soh recalls, "I remember I made a call in a townhall meeting at the beginning of the outbreak: that 'no staff is going to die' from COVID-19. We lost two TTSH staff during the 2003 SARS – Dr Ong Hok Su and Nurse Hamidah Ismail. It was a common intent – or purpose – that we're not going to lose anyone this time. It was borne out of conviction. We use the language of care – that we ensure every staff is safe and protected; that they protect themselves and for each other so they may protect their families and patients."

> Whatever that does not kill us, will make us stronger, as individuals, and as a TTSH family ■

ASSOC PROF CHIN JING JIH
Chairman, Medical Board, TTSH & Central Health

Protecting each other means a call for sacrifice for the greater good of the TTSH *kampung*. Only when there is a "stockpile of resilience and trust" can the 10,000-strong hospital ride through the storm. Everyone has to be onboard together. Staff from different departments need to put aside their own agenda and embrace what is needful for the hospital and patients' well-being. "We Are TTSH" has to fight this battle as one unit, not multiple divisions. Individual pride, benefits and recognition should not be in the equation. Sacrifice must take priority.

"I saw how my leaders fought alongside us at the Screening Centre in full PPE, working doggedly in uncomfortable environments, including the extended tentage overnight, especially on the "Most Terrible Monday" (23 March 2020) when we had to perform more than 500 X-rays. I'm inspired by their exemplary leadership," observes Senior Radiographer Genevieve Liew Qian Wei.

"In the early days of the outbreak, I had to assure my doctors working in the Screening Centre that we need not be fearful of the disease, despite limited information on the novel virus. I told them that the PPE would adequately protect us, and as long as they practised good hygiene, they should be alright. I also told them that they had to work hard in the fight. Having said that, as their shift leader, I needed to work even harder. I could not simply send them to the frontline of the battle – like stepping into a minefield first – and stay at the back. I had to be with them in the front, to lead by example," answers emphatically Dr Michael Chia, Senior Consultant, Emergency Medicine. Dr Chia led teams at the Screening Centre throughout the outbreak.

"As leaders, our commitment is to protect the staff and to maintain a clear and regular communication channel with all of them, paying special attention to their needs and morale. Whatever that does not kill us, will make us stronger, as individuals, and as a TTSH family," assures Assoc Prof Chin Jing Jih, Chairman, Medical Board, TTSH & Central Health.

Community Health Teams being briefed before setting out to conduct swab tests at a nursing home.

UNDIVIDED FOR THE GREATER GOOD

The fight against COVID-19 is far from over. While the national vaccination programme reached a milestone on 29 August 2021, when 80 percent of the population had been vaccinated, vigilance to guard against complacency remains vital.[6] Some countries continue to experience a surge in the number of cases and deaths.[7] More concerning, cases of a new variant are appearing worldwide.[8]

The fight will not cease until the last COVID-19 case is eliminated from the surface of the earth. This means the bulwark of unity, common intent and sacrifice remains indispensable.

From sacrifices as simple as "no annual leave" to sacrifices as heartrending as "no goodbyes" between the dying and loved ones due to safe management measures; from "no pee breaks" to "taking over colleagues' shift duty for a week"; from taking care of only one department's staff to handling teams from several departments and institutions; these sacrifices carry no price tags.

But each sacrifice, made undivided, will inevitably yield enduring greater good. ■

TTSH staff conducting swab tests as part of hospital-wide stepped-up containment measures.

4

COMBATING THE COVID-19 CLUSTER

THE GENESIS

It was a test of epic proportion for TTSH. Never before had the hospital been summoned to respond so vigorously and extensively to contain an outbreak within its own battle line. It was a race against time, and against a COVID-19 cluster reported to have been sparked by a new, more virulent variant that originated in India, the B1617,[1] known today as the Delta variant.

On 28 April 2021, the hospital confirmed that COVID-19 had broken through its defence, with Singapore's first hospital COVID-19 cluster of five cases – a nurse, a doctor and three patients – all from the same ward, Ward 9D.[2] The first detected case in the cluster was reportedly a staff nurse, who developed symptoms of

Booths were set up at the hospital entrance to facilitate antigen rapid test (ART) for visitors.

> This situation is of concern and we are acting fast with a three-pronged approach to *contain*, *control* and *cast a wide net* to secure the safety and well-being of our patients and staff ■
>
> DR EUGENE FIDELIS SOH
> CEO, TTSH & Central Health

an acute respiratory infection on 27 April and dutifully reported her condition and consulted her doctor.[3] Her swab test result returned positive on 28 April. A Ward 9D patient was also reported positive that same day. The hospital suspected something might be amiss.

CEO Dr Eugene Soh recalls, "With the two cases, we knew that something was going on in that ward and we had to act very fast. Our nursing, medical leadership, infection control team and epidemiology team immediately went in to conduct a thorough investigation on 28 April."

What ensued was an all-in approach to ring-fence the cluster. From the leadership to the frontline, TTSH was once again thrust into a critical, heightened battle mode, this time alongside its continuing pandemic support response at NCID. The new variant poses new challenges. It has higher attack rate and is more infectious.[4]

In consultation with the Ministry of Health, decisive and immediate measures were rolled out from 29 April: ward lockdown; staff in close contact with the five cases were put on Leave of Absence (LOA); no visitors to the wards; all staff at the Main Ward Building had to undergo swab tests; suspension of admission; segregation of hospital zones established, etc.

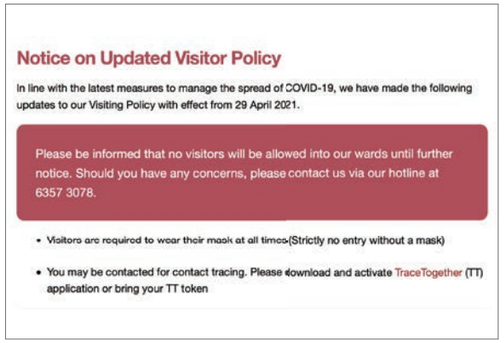
In his CEO Statement on 30 April, Dr Soh made a rally call to all staff and set out the hospital's approach to managing the growing cluster, "We are fighting an invisible enemy, an enemy that can change its form, and an enemy that has become more infectious . . . This situation is of concern and we are acting fast with a three-pronged approach to *contain*, *control* and *cast a wide net* to secure the safety and well-being of our patients and staff."[5]

Dr Angela Chow Li Ping, Head of the Department of Clinical Epidemiology, working with her colleagues to escalate contact tracing efforts.

RING-FENCING THE CLUSTER

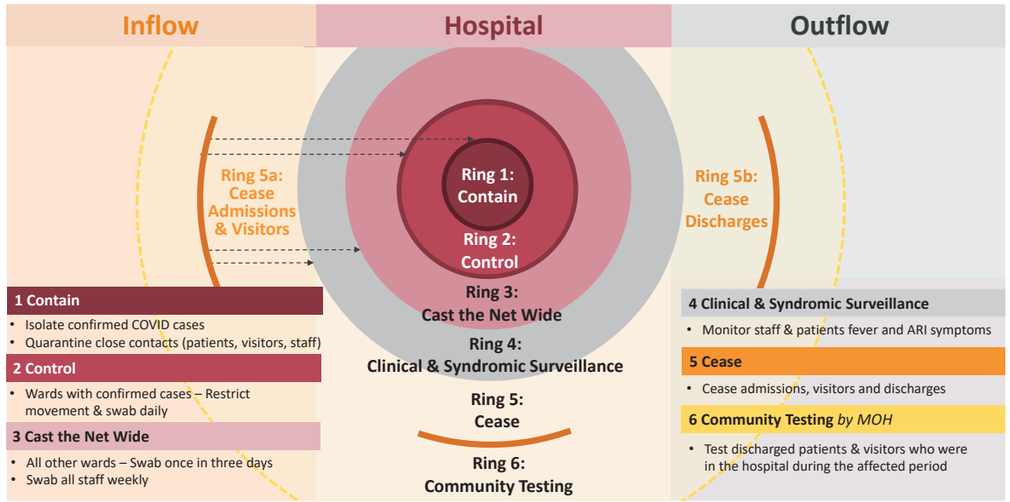
From the onset of the cluster outbreak, the top-of-mind priority was to secure the premises of TTSH-NCID, protect and safeguard all patients and staff from being infected and put in place strict outbreak measures – all of which to effectively ring-fence it from escalation *within* and *without* the campus. Four "rings" were methodically and swiftly fenced:

- 1st ring: Moved all close contacts into isolation;
- 2nd ring: Locked down the affected wards, where patients were confirmed to be at; no visitors were allowed to the wards/hospital; staff were instructed to be in full PPE for protection as much as possible;
- 3rd ring: Cast a wider net by swabbing all patients and staff (plus community testing); at the same time, extensive routine swab tests would be conducted for patients and staff;
- 4th ring: Instituted a strong clinical and staff surveillance programme.[6] Between swab tests, staff who were unwell and presented acute respiratory infection (ARI) symptoms should immediately consult a doctor. All staff were required to take their temperature twice daily.



Posters were put up to advise on the "No Visitors" policy.

The four rings were assiduously fenced throughout the COVID-19 cluster period (28 April to 17 May 2021), serving as a sweeping bulwark to the hospital's three-pronged approach to containing the spread.



A graphical summary of how TTSH rolled out its containment measures to ring-fence the COVID-19 cluster.

THREE-PRONGED APPROACH: CONTAINMENT, CONTROL AND CAST

One day after the confirmation of its cluster, TTSH-NCID on 29 April rolled out its most comprehensive outbreak management measures yet in its entire history. The HOM[7] strategies had to be matched by speed and single-mindedness. The three "Cs" approach – *containment*, *control* and *cast* – was to first and foremost secure the safety and well-being of the hospital patients and staff.

Containment Measures

To stem the spread, containment measures were stepped up.[8] Four wards – 9D, 9C, 7D and 10B – were immediately locked down. Patients and staff working in the affected wards were isolated and tested. All close contacts of the cases, including patients, visitors and staff who had been in these wards were quarantined or placed on LOA.[9] By 30 April, 61 patients including confirmed patients were transferred to NCID; more than 1,000 staff were placed on LOA or Quarantine Order (QO), comprising over 300 medical doctors; 300 nurses; 200 allied health, and 150 admin & ancillary staff.

Meanwhile, the Staff Movement Restriction Policy and Hospital Segregation Zones (Segregation Strategy) were introduced. Staff and patient movement in the hospital's main wards was minimised to prevent cross-infection. Medical, nursing, allied health and support staff were re-assigned to work in segregated zones and on split team arrangements. No visitors were allowed except for critically ill patients. In addition, elective cases were deferred. Accident and emergency cases (A&E) that were not life-threatening were redirected to other hospitals. Admissions to TTSH ceased immediately. Discharges to ILTC Facilities were ceased too. It was one of the most daunting times the hospital had ever confronted.

"Every second counts, every person matters. To rebuild a defence that had been breached by the insidious

Deep terminal cleaning was carried out in the affected wards amid the cluster outbreak.

COVID-19 virus, we had to work 24/7 to re-secure the hospital premise. The efforts were relentless. What was truly noteworthy was to witness the unreserved commitment and fearlessness of our staff. The very best of 'We Are TTSH' spirit was in full display," extols Assoc Prof Chin Jing Jih, Chairman Medical Board.

Ms Prema Harrison, Senior Nurse Manager.

Chief Nurse Dr Hoi Shu Yin, speaking to the ward staff during the 7 May staff engagement session adds, "At the end of the eventful day – 28 April – I had to make the difficult decision to send a confirmation email to the Department of Clinical Epidemiology (DCE) – to confirm that our staff had to be sent for LOA or QO. I must say it was a very tough decision and I just want to 'thank you' from the bottom of my heart . . . I know it is very tough for you, especially with elderly parents or young kids and I think you have taken it in good stride and have been very positive."

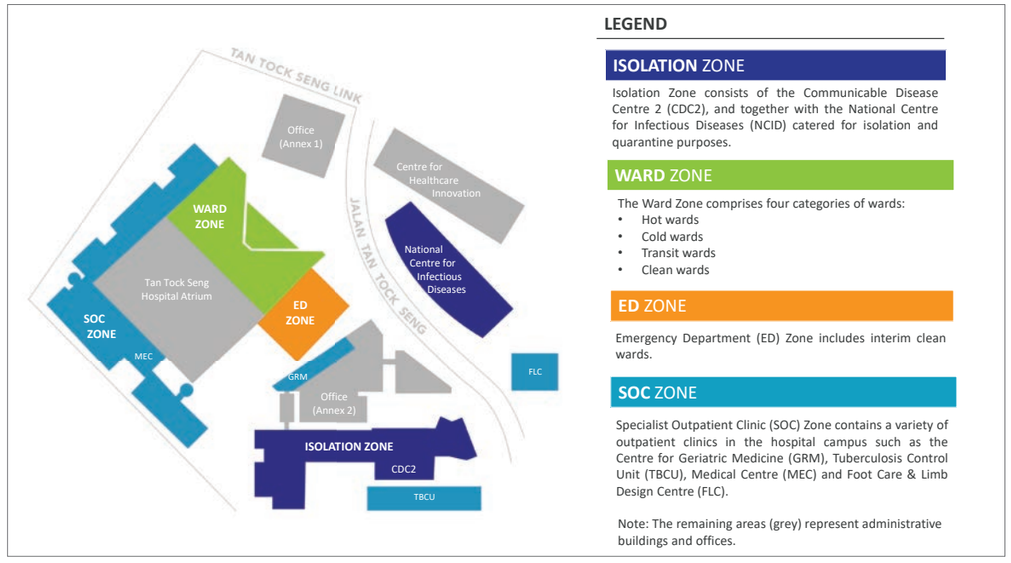
Ms Prema Harrison, Senior Nurse Manager, Level 9, who was one of more than 300 nurses quarantined, recalls, "I was then very worried that my neighbours would see me get into the ambulance. So I brought my sunglasses along, to rush into the ambulance, and I'd never dashed into the ambulance as fast as I did that day. In my haste, my sunglasses fell and everyone could see my face and everything! All said, I was doing well during the quarantine, thanks to the support and the concern of senior management and nursing leaders . . . Indeed, life comes with many challenges, the ones that should not scare us are the ones that we can take on and take control of."[10]

> "I was doing well during the quarantine, thanks to the support and the concern of senior management and nursing leaders ■
>
> PREMA HARRISON
> Senior Nurse Manager

Control/Surveillance Measures

The second "C" involved control/surveillance measures. Clinical surveillance was extended to cover all inpatients who might develop fever or ARI symptoms. Given the possibility of asymptomatic COVID-19 cases, all patients and staff in other wards – apart from the four locked-down wards – were routinely tested.

Meanwhile, infection control measures were reinforced, coupled with strict hand hygiene practice and PPE compliance for all staff. Cleaning and disinfection process – and its frequency – was also enhanced throughout the hospital.



Hospital Segregation Zones.

Enhanced staff surveillance including twice daily temperature monitoring, was enforced. In cases when staff were unwell, they should immediately seek consultation at an on-site staff clinic and not report for work. In this regard, CEO Dr Soh reiterates, in his 6 May townhall meeting, "I want to personally thank our nurse who went to see her doctor on 27 April when she was unwell. It was a very responsible action that she'd taken. This allowed us to respond to the entire cluster situation, because she was an early warning sign for us. So, her responsibility to see the doctor was critical, otherwise, the situation would have been much worse."

All staff were required to monitor and submit their daily temperature as part of enhanced staff surveillance measures.

Cast a Wider Net to Prevent Further Spread

To effectively limit the spread of the cluster – to contain potential and hidden risks – the hospital conducted mass screening for all inpatients and staff working in the wards, starting 29 April. By 2 May, 1,100 inpatients and 4,500 ward staff working on various shifts, comprising doctors, nurses, allied health professionals, housekeepers and support staff, were swabbed. At the same time, no visitors were allowed to wards till further notice. Exception was for critically ill patients on a case-by-case basis, based on compassionate grounds. Still, patients continued to receive photos and messages from their loved ones, and reciprocally, their next-of-kins received patient recovery updates via video calls and texts. Patients were also each given a journal pack comprising an activities planner, art & craft sheets, as well as goodies and treats. All of this was to keep them actively engaged and emotionally well.

On 1 May, the hospital had its first cluster-related COVID-19 death, an 88-year-old Singaporean woman. Arrangement was made for her family to conference her on the day before she passed. Her relative was able to visit her with full precautions from outside the isolation room. On 20 May and 7 Jun (a day after the TTSH Cluster was declared closed), the hospital saw the second and third cluster-related COVID-19 deaths, a 70-year-old man and an 86-year-old-woman respectively. In total, there had been three COVID-19 deaths related to the hospital cluster.[11]

Beyond the hospital's walls, TTSH's containment measures were complemented by MOH's wider ring-fencing in the community. Mass testing of patients and visitors who had been to the hospital during the cluster period was conducted from May 3 to 16. In total, 28,000 were tested, consisting of over 12,500 people who might have been exposed to the cluster and who volunteered to be tested, 12,000 TTSH staff and 1,000 patients, as well as close to 2,500 individuals who were quarantined following contact tracing.[12,13]

A specially designed "Condolences Wall" was set up to remember those who had passed away due to COVID-19, and to encourage frontline staff to persevere in their fight.

Within the hospital, the swabbing results for all sweeps had consistently returned negative. "This gives us added assurance that the containment measures are tight, and our processes have been in place across the hospital. As we progressively reopen our hospital, we will continue to monitor the situation closely and stay vigilant and strengthen our defences," CEO Dr Soh observes in his press statement to the media on 17 May.

Efforts to regularly conduct swab tests, work at safe distance and clean the wards were stepped up.

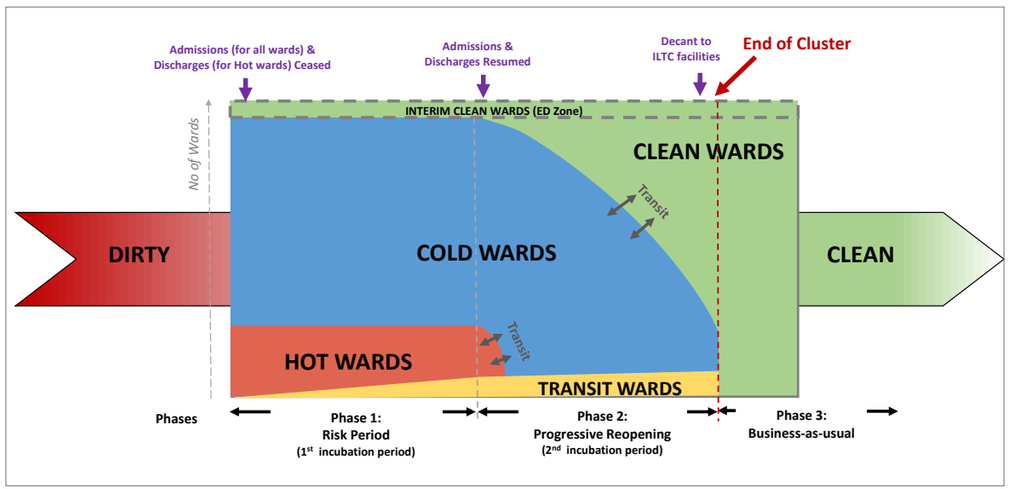
RESETTING FOR SAFE & PROGRESSIVE OPENING[14]

On 18 May 2021, at 8am, 21 days since TTSH first waged battle with the COVID-19 cluster in its midst, TTSH opened its doors to admit patients again. The milestone had been achieved with incalculable sacrifices and unremitting commitment. As mentioned earlier in this chapter, extensive, myriad HOM measures were put in action and massive efforts were launched to conduct six rounds of testing for all 1,100 inpatients and two rounds for all 12,000 staff on campus. Assuredly, the 47 community cases and one death linked to the cluster (up to 17 May) had remained constant for more than two weeks. All these – strict defensive HOM measures, consistent "negative" test results of inpatients and staff and stable cluster size – established a "safe benchmark" for the hospital to roll out a calibrated progressive reopening regime.[14]

The hospital began by working with the Singapore Civil Defence Force (SCDF) to take urgent ambulance cases to the hospital's Emergency Department 8am-8pm daily, and commenced seeing urgent clinic appointments and electives during the reopening.

Three-Pronged Defensive Approach During Reopening

To reduce the risk of hidden infections as it reopened its doors, the hospital also assumed a three-pronged approach in bolstering its lines of defence. This meant

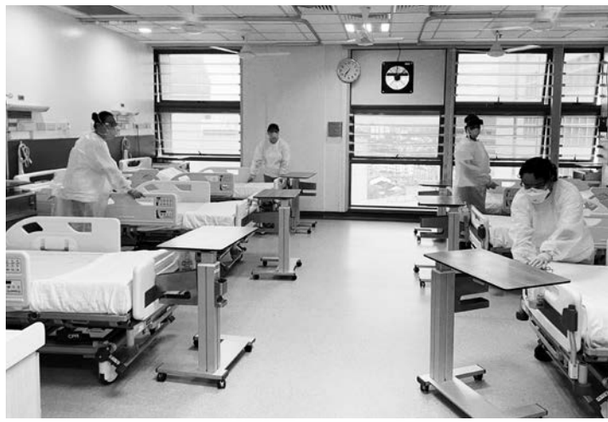


Resetting the hospital to re-open safely and progressively.

A race against time to design and manufacture brackets to install exhaust fans in the wards.

strengthening its protocols to *test more regularly*, *monitor closely*, and *protect its patients and staff*.

All patients who were admitted would be swabbed on admission, on a regular schedule during their stay, and prior to their discharge. All inpatients had to don surgical masks (if they were able to wear one based on their medical condition). Visitor restrictions remained for the next few weeks; only one pre-registered visitor per patient, with a limit of one visit per day of up to 30 minutes. They had to be



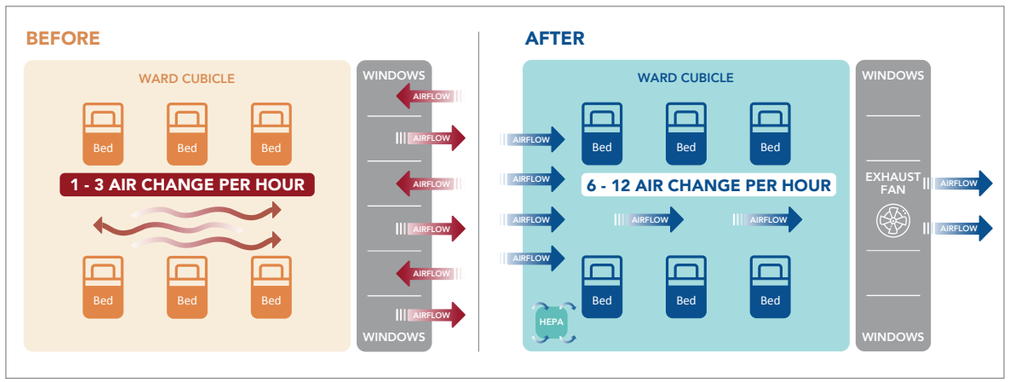
Aside from installation of exhaust fans, cleaning regimes were stepped up in the wards.

masked at all times, and to refrain from eating or drinking during their visit to the wards.

The progressive reopening of the hospital was phased with the return of staff who had been serving their LOA or QO. All staff had to undergo routine rostered testing (RRT) at regular intervals, with an ARI clinic set up for staff on campus, and to adhere to the enhanced staff surveillance protocols with mandatory twice-daily temperature monitoring and sick leave surveillance. Additionally, PPE was stepped up across the hospital to protect the staff.

To better protect patients and staff, cleaning regimes across all wards and the entire hospital were also stepped up. Increased frequency saw wards cleaned from once to twice a day, with dedicated housekeepers for every ward. Disinfection of all high touch surfaces was extended to twice a day. Training for its housekeeping team and cleaning audits was also intensified to ensure high standards. The heightened cleaning routine was complemented by deep cleaning and enhanced decontamination using ultraviolet and hydrogen peroxide vapour for affected areas.

In addition, the hospital installed exhaust fans and HEPA[15] filters in wards.[16] Exhaust fans suck out hot or humid air from a room and expel it outside. Clean air enters through a doorway or vent. Installing these filters in the ward help to purify the air in the area.



A graphical illustration of the effects of installing exhaust fans and HEPA filters in each ward cubicle.

KEY LESSONS

Combating the COVID-19 cluster had significantly tested the robustness of TTSH-NCID's HOM in the face of a major outbreak, and arduously stretched the resolve, resilience and solidarity of the management and staff. While it had passed the first test of ring-fencing the cluster, the hospital had to remain vigilant. It would not rest, it could not rest.

Lessons for the Future

Vitally, as the hospital marked the official cluster closure on 6 June 2021,[17] many key lessons had been gleaned from the episode. They will serve as important guideposts for future outbreak management. First, it needs to strengthen the lines of defence by early identification of COVID-19 cases through the principles of *test*, *monitor* and *protect*. The "test, monitor and protect" measures have been exemplified earlier in the chapter. Second, it has to continually develop an enhanced preparedness protocol broadly categorised under the 3Cs: 1) *contingency* to respond swiftly and effectively to evolving outbreak scenarios in securing and protecting patients and staff; 2) *communications* to patients, staff and community partners, and to the public on the measures and progress in managing an outbreak; 3) *care* for the well-being of patients and staff.

Care for Patients

No efforts were spared to steadfastly care for the well-being of patients even amid the cluster lockdown. As no visitors to the wards were permitted, the hospital staff had to conceive ideas to convey emotional support from loved ones to the patients. An initiative to crowdsource via TTSH Facebook – to send photos and messages to loved ones warded – was eventually launched. In the 72 hours prior to 9 May – Mother's Day – the hospital received countless heartfelt messages and photos of families, friends and little ones. Ms Margaret Ong, a patient and a mother,

During the period of no ward visitations, staff actively supported and engaged patients with various activities.

was very appreciative, and posted this on the TTSH Facebook page, "A big thank you to all TTSH doctors, nurses and healthcare staff. This initiative is indeed a lovely idea . . . a heartfelt thanks to the team who motivated this Happy Mother's Day to all."[18]

Another post by a Kerlson Tan, added, "Thank you to all the staff of TTSH for taking care of the sick while in the midst of battling one of the most darkest moment of our time. Please take good care of yourselves too. We root for you always."

Care for the Staff

While frontline staff – including nurses, doctors, allied health professionals, cleaners and security guards – had been valiantly defending the lines amid a dangerous cluster, there had been nonetheless unfortunate incidences of the public shunning them.[19]

Many TTSH staff members encountered problems when the hospital emerged as a cluster. For example, when they were in uniform on public transport, passengers would move away from them or wear their masks tighter against their faces. One staff member said on Twitter that drivers on ride-hailing services had repeatedly cancelled her rides after they saw that she was going to TTSH.[19]

To their defence, then Health Minister Gan Kim Yong, stated in Parliament, "Some of them have been asked to move out of their homes by their landlords, some of their co-workers are shunning them. I think these are wrong . . . we should not condone such actions . . . We are concerned about the well-being of the healthcare workers and do need to find ways to help them and support them."[19] Prime Minister Lee Hsien Loong, added in his Facebook post, "We cannot let setbacks divide us or wear us down, because if we lose our unity, the virus has won." He continued, "It would be a thoughtful gesture to cheer them up and urge them on. Don't lose heart, TTSH. Singapore is with you!"[19]

Outpouring of public support for TTSH-NCID staff followed effusively after stories of discrimination against them came to light.[20] Various private firms offered expressions of appreciation to healthcare workers, for instance, by providing free bubble tea and discounted private-hire car rides. "Care pack" filled with goodies, plus a total of 5,000 handwritten thank-you cards penned by students and residents from housing estates, were prepared as part of Project #SGHeroes by the North West Community Development Council (CDC) and grassroots organisations of Yew Tee.[20]

Outpouring of public support for TTSH-NCID staff was evident following stories in the press.

> It would be a thoughtful gesture to cheer them up and urge them on. Don't lose heart, TTSH. Singapore is with you! ■
>
> PRIME MINISTER LEE HSIEN LOONG

A light projection on the main hospital building to spur TTSH-NCID staff on to keep going.

Ms Cristy Kaharian Macandile, 45, a cardiac technician, says to *Today*, "We are facing a challenging experience but many people are showing their support. It is very heartwarming to see the *kampung* (communal) spirit that continues to live on during this period."[20]

Mr Tan Ren Siang, 26, a clinical research assistant, adds, "I feel very touched by the kind gestures from members of the community, to show unity in supporting TTSH staff during this difficult period."[20]

CEO Dr Soh reiterates, "We are thankful for the outpouring of goodwill and the strong rally by our community to support our hospital during this pandemic. It has brought much comfort and cheer for our staff. Thank you very much for supporting our frontliners at TTSH."

Assoc Prof Habeebul Rahman, chairman of the hospital's well-being committee, recalls to *The Straits Times*, "We had to deal with a significant loss of manpower, and needed to shuffle (staff) around to ensure patient care was managed, while keeping up the morale of staff who were under quarantine order. When your own staff and friends are suddenly affected by something unknown, it can hit home quite strongly ... what was truly heartwarming for us was that very quickly other members of the public

We are better together because we battle together ■

PAUL YONG
Chief Financial Officer, TTSH & Central Health

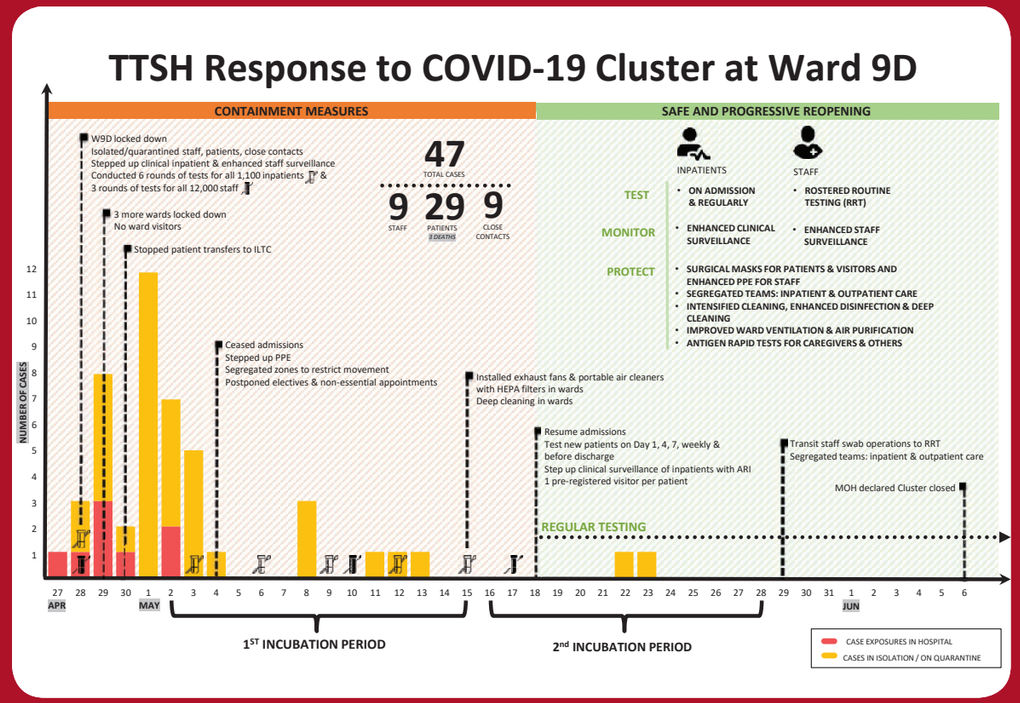
came in to offer their support and the next thing we know, we've got goodwill pouring in."[21]

To boost efforts in supporting staff well-being, TTSH introduced apace a suite of initiatives,[21] including forming support teams for staff (and patients) who had to be quarantined, mobilising trained welfare officers to be stationed at each department, and conducting workshops and online learning modules to promote mental health among the staff. A chatbot also facilitated staff's access to mental health modules, where they could plot their mood graphs and chat with the bot to navigate feelings of distress. Mindfulness sessions on Zoom and TTSH Workplace and morale boosters such as Zumba over Zoom were also conducted. For staff having trouble finding a place to stay, the hospital, with support from MOH, partnered with hotels to provide alternative accommodation for staff, with its costs aided by TTSH. For staff who needed urgent specialist review and who were unable to access their scheduled appointments at other healthcare institutions due to their respective visitor restriction policy, a dedicated Staff Support Specialist Clinic was set up. This is notwithstanding the fact that other public healthcare institutions continued to accept patients seeking care, including TTSH staff.

Communication was also cranked up with its 12,000 staff, through live townhalls on its internal Workplace platform, staff chatbot, intranet, CEO tribunes and leadership support at all levels. Finally, the ongoing staff support staff programme (3S) continued to provide those who needed help in coping with the added stress during the challenging period.

In delivering *better care* to its patients as its core mission, the hospital upholds it by first delivering care to its staff and ensuring their well-being so that they can continue to treat and care for their patients confidently and safely.

Health Minister Ong Ye Kung, who visited TTSH after its re-opening, wrote on his Facebook post,[22] "TTSH is getting back on its feet . . . Everyone working at TTSH has shown resilience, professionalism and dedication . . . let's continue to cheer our healthcare workers on."



A timeline that records TTSH's response to containing the COVID-19 cluster and re-opening.

BATTLE TOGETHER. BETTER TOGETHER

The fight continues as the hospital regears and reinvigorates itself for a long COVID-19 battle. The many key lessons learned from the cluster episode, the support it has received from the national leaders, the community and the public, and its '*kampung* spirit' will serve it well – to prepare for its next chapter of the pandemic.

TTSH-NCID is better prepared because it battles together – as one.

TTSH Chief Financial Officer Paul Yong observes, "We are better together because we battle together."

"The end of the tunnel is not too far away. If we look out for one another, if we do it together, that day will come sooner," concludes Assoc Prof Chin Jing Jih, Chairman, Medical Board, TTSH & Central Health. ■