

SINGAPORE GENERAL HOSPITAL

# PURPOSE WITH PASSION

*Our  
COVID-19  
Stories*



—•—

*This book is dedicated to all  
our colleagues – you define  
what it means to be healthcare  
professionals – and to everyone  
who stood shoulder to  
shoulder with us.*

—•—



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Chief Executive Officer*

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## FOREWORD

**WHAT THE WORLD** went through in 2020 and 2021 has been nothing short of unprecedented. SGH was not spared, as our colleagues shouldered the responsibility of tackling the pandemic even as we continued to care for all our patients. The idea for this book surfaced towards the end of 2020, as we had an opportunity to reflect on what had transpired in the year. We found that with the unrelenting and rapid sequence of developments and the evolution of the disease, our memories were starting to fade, and we were having difficulty recalling exactly how events unfolded. We resolved that our stories must be told – what we did, how we did them, and why.

This was important not only to recognise the contributions and achievements of our colleagues, but to offer a record of what happened in SGH, from the personal perspectives of our colleagues. We did not set out to offer guidance on how to manage a pandemic, as this has been a deeply humbling time. Indeed, the course of COVID-19 continues to demonstrate that it has much more to teach the world.

The many first-hand accounts in this book speak of our humanity – our fears and anxieties, our despair when it seemed there was no end in sight, as well as the symbiosis of our actions. In the telling, some colleagues found psychological relief to openly express the strong emotions they felt, while others used the opportunity to pen thoughtful, reflective pieces. Most of all, everyone celebrated the special camaraderie born out of a shared Purpose, to serve with Passion when our community needed us most.

Even as the virus continues to lurk around, the stories serve as a record of the triumph of the human spirit – when ordinary people did extraordinary things. Yet, every single one in SGH would say that they just did what they had to do. As we close our Bicentennial year in 2021, it is clear that this is what SGH has always done – rising to challenges and putting our patients at the heart of all we do.

I am truly humbled, and proud to be counted among the number in SGH.

**DR KENNETH KWEEK**  
Chief Executive Officer

## PREFACE

**I REMEMBER** the morning in 2020 when I acceded to CEO's request to be Chief Editor of the SGH COVID-19 book. There was a lull in the COVID-19 battle. The local epidemiologic curve was sloping downwards. On the drive home, one encountered tree pruning and grass cutting – unmistakable signs that the migrant workforce, a sector hard hit by the virus, had come through the worst of COVID-19.

I was jolted out of these thoughts by CEO's mention of COVID-19 successes and fading memories. Success seemed a strange word to use when speaking of an epidemic. But, upon contemplation, not entirely baseless. If SARS had revealed our weaknesses and punished us for our naivete, COVID-19 appeared to have given us a chance to redeem ourselves. In those first nine or ten months of the pandemic, no cluster had formed in our wards, and no staff had caught the virus from a patient.

As for memories, well, the Straits Times would, in late 2021, remark that the mask would one day be found in some handbag in the attic, a relic of another time. An optimistic sentence (suggesting the pandemic would end!) but one recognising the frailty of memory. Indeed, as editors working our way through the book, we noticed how easily the memory failed – the mind lived history as a series of impressions, not facts.

Documenting good work done in extraordinary times seemed to be fair basis for a book. But who would we write the book for? Why would anyone read a book on COVID-19 and SGH?

The whole world confronted COVID-19 in one way or another. The mainstream press, social media and the academic literature were awash with tales of the destruction wrought by the virus. People who did not write professionally had turned to writing to share heart-wrenching experiences – intensivists numbed by the unquenchable cytokine storm in their patients, lay persons desperate for oxygen tanks, and the hapless many who had to let their spouse or parent go “in peace” without that last caress. What did we have to share that people might find worth reading? Singapore had a very low death rate, the hospital never ran out of Personal Protective Equipment (PPE), no one had been denied an Intensive Care Unit (ICU) bed.

The editors came to a modest goal. We would write a book, first and foremost, for our staff. The staff themselves would provide the stories, recording how they navigated the choppy seas of the pandemic. The book would be a tribute to the staff.

In our dotage, we may be asked by our grandchildren what life was like as healthcare workers in the first pandemic of the century. With memories hazy from the passage of time and perhaps, incipient dementia, recourse to the book may provide opportunity for reminiscence, and protection from embarrassment. Yes, the book will be a historical record – a relic from another time, sure, but one that paints a vivid picture, mounted on facts. A student of history who, 50 years hence, dips into the book, will appreciate better the role that SGH played in Singapore's campaign against COVID-19.

This collection of stories will appeal not just to SGH staff and history buffs, but also the casual reader. We have been candid and have exposed our inner workings, the cogs and wheels behind the clock face. If you ever wondered, from the confines of your homes, what your doctors and nurses did when your appointments were postponed, this book is for you.

The book is an amalgam of the editors' words and our staff's writing. We invited everyone to contribute their thoughts, experiences and feelings. But we knew that not all would write. A great many remained in the thick of action, even in late 2020, and more so in 2021. We also understood that writing was not everyone's cup of tea. Hence those Zoom interviews. We thank those who shared their stories with us.

In the course of this long pandemic, somehow we had a new COVID-19 ward, fully staffed, fully functional. Somehow the polymerase chain reaction (PCR) test, then the serology, and then the drugs, could be ordered on the computer. Somehow the data that the Ministry of Health (MOH) wanted were ready. Someone worked extra hard, sometimes overnight, to make these things happen. We are unable to name everyone who did the things that mattered. We apologise, unreservedly, to the many who remain unsung heroes.

The book has to be accurate yet readable. We have eschewed jargon as best we can, and we provide context through the fact box and the footnote, aware that we are insiders, and concerned about those fading memories. Even now, in early 2022, few can recall the elements of the "stabilisation phase"! The name of the virus

and the illness changed a few times, and we have chosen to use the name that was current at the time of a particular story. Titles and appointments are ephemeral (yes, despite the pandemic, promotions happened!), so we refer everyone by their official appointment in mid-2020. Only Emeritus Consultants are referred to as Professor in the footnotes, because verifying everyone's academic title proved to be overly onerous a task. As people will thumb through different sections of the book at different times, we spell out acronyms in full, and footnote individuals at the first mention in every chapter.

The book has had a long gestation and many thanks are in order. First, my gratitude to the rest of the editors, for putting this book together, and for tolerating me – my quest for consensus and fastidiousness with language must have been maddening, for everyone was fighting the pandemic right through it all. We are indebted to all who contributed, either in writing or via the interviews – their words form the bulk of this book. I would reserve a medal for Sai Luan, who acted as co-editor, Zoom host, fact checker, external liaison, and everything else in between. Our publishers likely did not anticipate such a protracted effort, nor such a difficult taskmaster, when they tendered for the job. We thank them for repeatedly accommodating us, and for giving us the independence we desired. We merely wrote; they brought the book to life.

**DR TAN BAN HOCK**

Chief Editor  
Senior Consultant,  
Department of Infectious Diseases

←  
Ward 52B ICA/General Ward



## PROLOGUE

**ON FRIDAYS**, the Infectious Diseases (ID) community in Singapore gathers to present clinical challenges to one another. That Friday in March 2003, we heard the Tan Tock Seng Hospital (TTSH) ID team describe a pair of fellow travellers who were down with pneumonia of unknown aetiology. Most ominously, healthcare staff who had looked after them had fallen ill.

We were all novices then. The toll that novel pathogens could take on people, hospitals and societies was not something we understood. We were filled with a vague sense of unease, but we did not know what we were uneasy about.

One week later, an ID doctor developed fever while on his way back to Singapore from a course in New York. Television footage showed how, upon landing in Frankfurt, he was transported by men in full protective gear to an isolation hospital. The Germans did not miss the opportunity to show off their virological prowess – within days, they had identified, via electron microscopy, the culprit virus responsible for the pneumonia spreading in the wards in Singapore, Hong Kong and parts of China.

Meanwhile, at the Singapore General Hospital (SGH), a man who had recently been treated at TTSH was admitted for gastrointestinal bleeding and fever. Due to his recent admission to TTSH, isolation

was considered, but he was deemed too ill to be in a single room. Ignorance of the wiles of the coronavirus was bliss.

The word “super-spreader” was soon to be coined. Eleven SGH nurses reported sick – all from the ward where the ex-TTSH patient had resided. As suspicion once more zeroed in on him, his chest X-rays were reviewed by several senior doctors, and all confirmed the absence of pneumonia. Still, the fact had to be faced that contagion had set in. At an evening meeting that stretched into the night, the decision was made to amputate the entire ward of doctors, nurses and patients, and implant it in TTSH – a massive operation called humiliation.

A punishing series of bad news followed. Staff fell ill, and a few perished. Contact tracing linked one, and then another, of Singapore’s rising numbers to the SGH super-spreader. At press conferences, pressmen, armed with the wisdom of hindsight, grilled SGH’s leaders mercilessly. The hospital floundered on, with staff struggling with new and strict infection control rules, while feeling helpless in a sea of adverse publicity.

Of all the lessons SARS taught us, one would become a guiding principle – never again.



**CHAPTER 1**

# Forward Into Battle

“Hi Doctor, there is a patient for admission.”

As a medical officer (MO) on night float, we probably hear this at least 15 times a night. Little did I know that this was going to be my first contact with a patient harbouring the novel virus.

When I walked in to see the patient, he was coughing vigorously. I reviewed the epidemiological history and found out that he was from Wuhan.

“Did you go to the seafood market?” I asked instinctively, as the infamous seafood market was already synonymous with the virus. He denied sheepishly initially, but continued shortly after I probed a second time, “Actually, I visited the market with my son about three weeks ago.”

The silence that ensued was deafening: between the patient and myself, I suppose, we both had a gut feeling of what that meant.

There was plenty to do after that. Taking his swabs, keying in my findings, calling the Infectious Diseases (ID) consultant on-call, and notifying the Ministry of Health (MOH), all of which had to be done within one hour of his admission.

The patient’s son<sup>1</sup> was outside, gesticulating frantically and coughing – without a mask! He was eager to find out when the swab result would be ready. I handed him a mask and recalled asking, or probably berating, him to go to the Emergency Department (ED). It was adrenaline that kept me going through the rest of the shift.

At the back of my mind, the uncertainty of the whole situation remained perturbing.

The next day, at about 9:00pm, while I was again busy in ward 68<sup>2</sup>, my phone buzzed incessantly. After I de-gowned, I saw many messages of support, with some directing me to check my email. It felt almost surreal the moment I read the memo that the patient I had seen yesterday tested positive for the Wuhan virus. From that point on, there was no letting up. After my week of night float, the whole of ward 68 was full; uncertainty became the new normal.

**SAMUEL KOH**

Resident, Internal Medicine

<sup>1</sup> The patient’s son also tested positive for the virus, and became SGH’s second patient with the novel infection.

<sup>2</sup> For more details of how Ward 68 was set up as SGH’s state-of-the-art Isolation Ward, see Chapter 2.



## New year, new battle

On 23 January 2020, the government of China imposed an unprecedented lockdown in Wuhan, a city of 11 million people. Its aim was to stop the spread of a mysterious novel coronavirus. Thousands flocked to leave the city as people rushed to be with their families for the Lunar New Year. But the virus had already escaped, as cases had been diagnosed outside China even before Wuhan was locked down.

On the very same day, Singapore confirmed its first case of infection with the novel coronavirus.

## Race against time

With the confirmation of the first case, Singapore General Hospital (SGH) went on a war footing. The Emergency Department (ED) immediately became a battleground.



The Department of Emergency Medicine was swamped with both COVID-19 patients and other patients.

<sup>3</sup> World Health Organisation. Novel Coronavirus (2019-nCoV) Situation Report - 3. 23 January 2020 [pdf]. Available at: [https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200123-sitrep-3-2019-ncov.pdf?sfvrsn=d6d23643\\_8](https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200123-sitrep-3-2019-ncov.pdf?sfvrsn=d6d23643_8).

<sup>4</sup> Zhu N et al. A novel coronavirus from patients with pneumonia in China, 2019. N Engl J Med 2020;382:727.



## FACING THE VIRUS

I will not forget the day when we heard of the virus that came from Wuhan. We were told to get ready and start pre-screening measures and prepare our isolation facility. At first, we thought that this was going to be similar to MERS-CoV<sup>5</sup>, where we screened and moved suspects into our fever zone<sup>6</sup>.

Going to my first Command Centre<sup>7</sup> meeting for the Wuhan virus, my initial feelings were a mix of excitement and pride, because we were finally going to show the world what our Emergency Department (ED) was all about. I was going to be the Head of Department during this pandemic and the ED would do very well.

Everything changed on the day we detected the first case in Singapore – it dawned on me that this was very different. The first few days were some of the most challenging ones of my young headship. We were flooded with a lot of tourists who came to see us. Usually, we would have 10 to 15 patients a day in our fever zone. After the first case, the situation exploded. Every day, there would be 50 to 60 patients – tourists or returning Singaporeans – with features worrying for the novel infection. We really couldn't cope, be it in terms of space or manpower. We spoke to senior management and they gave us part of the Ambulatory Surgery Centre (ASC)<sup>8</sup>, a facility adjacent to ours.

Together with non-suspect cases, we began hitting about 400 cases per day. As the department became crowded and the wait time lengthened, the nurses struggled to separate those with and without worrying clinical features. With long queues, people turned hostile. It didn't help that many of the tourists turned up with luggage in tow.

As I walked the ground and saw our young doctors and nurses go into these fever zones, I could tell that they were so scared. We didn't know what was going on. With SARS, we could identify who had it, based simply on fever, and isolate them straightaway. However, this virus was different – fever was not a consistent sign.

<sup>5</sup> Middle East Respiratory Syndrome Coronavirus.

<sup>6</sup> During SARS, the ED did not have a clearly demarcated space where suspect cases could be placed, separated from other patients. In the immediate aftermath of SARS, a fever zone was created within the ED. In the years that followed, it was used to manage the ED attendees suspected or confirmed to have highly contagious diseases like chickenpox and tuberculosis. When the MERS outbreak erupted in the Middle East, anyone suspected to have the disease was also managed in the fever zone while in the ED.

<sup>7</sup> This was SGH's version of a war cabinet. It was led by Dr Tan Thuan Tong (Head and Senior Consultant, Department of Infectious Diseases). Almost all of senior management were in the Command Centre.

<sup>8</sup> For details on the ASC, see chapter 4.

## The weight on my shoulders

One incident caused me to break down. The junior doctor who saw the first COVID-19 patient had a very high fever the next day and had to be admitted to the Isolation Ward (IW). I couldn't visit him – that was the rule. My world crashed. I feared, not for myself, but for his life, his family – he was newly married. I called him, and he told me, "I am very scared. I can't see my family. I can't see my wife, I don't know what's going on ..."

I had an overwhelming sense of helplessness because there was nothing I could do. As more junior doctors and nurses were admitted for fever<sup>9</sup>, I had sleepless nights, fearing the worst.

A difficult decision was made to go into segregated groups to reduce the chance of cross-infection. Leave was cancelled, and those who usually spent only a portion of their time doing clinical work, such as clinician-scientists<sup>10</sup>, all came back to work full-time. Prof Anantha<sup>11</sup>, often regarded as the "Father of Emergency Medicine" in Singapore, also threw himself into the fray, working the full 12-hour shift.

I didn't want any of my guys to die,  
I wanted them to be safe. There was  
this dread of losing someone on my  
watch. If they died, how would I face  
their family?

Kenneth Tan, Head and Senior Consultant, Department of  
Emergency Medicine

<sup>9</sup> All staff who had fever or respiratory symptoms were classified as suspects. All suspects were admitted. None of the ED staff tested positive for the virus.

<sup>10</sup> Clinician-Scientists are clinicians who have won salary support from the National Medical Research Council and other funding agencies and therefore devote a large fraction of their time to research.

<sup>11</sup> Prof Venkataraman Anantharaman, Emeritus Consultant, Department of Emergency Medicine.

## Young ones to the fore

ID physicians began discussing the novel illness early in January 2020. A sense of foreboding gradually engulfed the department as cases appeared outside China. ID physician Tan Thuan Tong<sup>12</sup> knew that the duty roster would have to be changed. Patients who were either suspected or confirmed to have the new pneumonia would have to occupy the IW, and be looked after by a dedicated team of doctors.

An amended roster was released on 22 January 2020, just a day before the first case was confirmed. Thuan Tong weighed his risk mitigation plans. “I was very worried. There was too much to risk. I took out those with



ID physician Tan Thuan Tong (standing) led the SGH response, conducting Command Centre meetings which eventually went virtual.

<sup>12</sup> Dr Tan Thuan Tong, Head and Senior Consultant, Department of Infectious Diseases.

young children from the manning of the ward. We didn't know much about the virus then. After having been through SARS, I knew that there would be small lapses. I am sorry to say this, but it was intentional that I had very young people sent to the IW. Siew Yee<sup>13</sup>, Anson<sup>14</sup>, Yvonne<sup>15</sup> and Benjamin<sup>16</sup> were the true heroes. Even though it was a deliberate decision, if something happened to any of them, it was my call.” Hearing Thuan Tong's voice cracking towards the end of his sentence at a joint interview, Yvonne tearfully assured him, “It's OK, boss. It's OK. We're happy to help.”

## Chinese New Year's eve in the isolation ward

ID physician Yvonne Chan was the first specialist to be assigned to run the IW. She started on 24 January 2020, eve of Chinese New Year (CNY).

With a sense of trepidation, Yvonne kicked off the roster. “It was quite intimidating to be the first person to start because there was so much unknown. We just didn't know what the virus was, and suddenly we had our first case in Singapore. There was not much data on how to manage it.

“I started my morning with rounding, and the whole day continued with more rounding and answering phone calls. The calls were non-stop. Questions concerning who should be isolated or what to do when a suspicious case did not meet the criteria were difficult, as there were not enough beds initially. Will keeping a patient in an isolation room affect his care? On the other hand, not putting the patient there might lead to other people being infected. We were dealing with something with implications not just for patients, but also our colleagues, the hospital and the wider community.

<sup>13</sup> Dr Thien Siew Yee, Associate Consultant, Department of Infectious Diseases.

<sup>14</sup> Dr Anson Wong, Consultant, Department of Infectious Diseases.

<sup>15</sup> Dr Yvonne Chan, Associate Consultant, Department of Infectious Diseases.

<sup>16</sup> Dr Benjamin Cherng, Senior Consultant, Department of Infectious Diseases.

“Generally, we took a more cautious stance. But then we had to make sure that patient care was not compromised because of isolation status. We worked quite hard to ensure these things ran smoothly.

“So on CNY eve, by 5:00pm or 6:00pm, we were still in the IW. I was trying to sort out all the logistics, how to risk-stratify patients and where to put everybody. I didn’t think I would make it home for the reunion dinner. Somehow, we managed to wrap everything up and I left in time for dinner.”

## Equipped enough for battle?

Like other doctors at the very frontlines of the epidemic, Yvonne had her fears. Despite all the Personal Protective Equipment (PPE), she knew that a small slip was all it would take to be infected. There were times when, upon coming out of the patient’s room, she exclaimed to herself, “Oh gosh! I have definitely contaminated myself this time.” She remembered, “When I go back home at the end of the day, no matter how much I wash my hair, I still don’t know if I will get it. At the back of my mind, I think of the ‘what ifs’ – what if I get COVID-19 and die like some young doctor in China, which has happened. But when I am working, I have to cope with the work on hand, look at the patients properly, their needs and issues, and not feel afraid. When I wasn’t sick after working at the ward for so long, it became evident to me that the PPE was sufficient to protect me. I became less afraid.”

Even though there was the prospect of dying from it, I began to have clarity and focus, to know what I was living each day for.

Yvonne Chan, Associate Consultant, Department of Infectious Diseases



Staff in the IW being trained on how to put on Powered Air-Purifying Respirators, which they wore on top of N95 masks in certain situations.

## ID on-call for pneumonia (China)<sup>17</sup>

IW consultants had to field many calls about the new virus, on top of the usual ward rounds. While there were MOH criteria for a suspect case of the new illness, doctors instinctively knew the risk could not be limited to those strictly defined as suspects. Those possibly exposed included air crew, travellers who had met people from China while in Europe or America, taxi drivers who plied the airport route, and many more. In the earliest days, when the MOH criteria only included those who had been to Wuhan, there were plenty of worries about those who had come back from other parts of China. Which ward should such patients be admitted to if they had a cough? What if they did not have a cough but a leg fracture? And how should they be managed if they required an operation? The permutations were endless.

<sup>17</sup> The ID team learnt through the experience during SARS that fielding phone calls about the crisis was a job unto itself. A roster was created just for this purpose. In addition to established duties like ID on-call and Transplant ID on-call, the ID roster included an “ID on-call for pneumonia (China)”.

## Questions, questions, questions

And so, the ID team in the IW had their hands full just answering phone calls. ID physician Anson Wong remembered receiving a record of 120 calls in a day. “On one occasion, when I started to put on my gown and goggles to examine a patient, the calls came in a torrent. One hour passed before I could complete gowning up. But it was heartwarming to receive thank you messages in the evening from junior doctors who had contacted me several times during the day.”

Amidst the confusion that reigned in those early days, some of the staff also directed their questions to nurses from Infection Prevention and Epidemiology (IPE). Infection Prevention Nurse (IPN) Molly How<sup>18</sup> recalled that they, too, went on a rota. The calls went on till 3:00am or 4:00am. “How do we transfer a suspect case to the IW?”. “My patient's wife just came back from China, what PPE should we wear?”

As there was no textbook to refer to, the IPNs walked the staff through the best practices in infection prevention, step-by-step.

### WIDENING THE CRITERIA

Keeping the community safe, preventing clusters from forming in SGH and in Singapore – that meant widening the net as to who should be isolated.

SGH did not just stick to official criteria for a suspect case when deciding who to isolate. This soon allowed the team to win another first – confirming the virus in the first local who had not travelled (and subsequently in her household members). This was a sentinel event that marked the start of community transmission of the virus in Singapore. Later in the outbreak, the ID team described the value of giving frontline doctors the leeway to isolate beyond official criteria. The team was happy when their principles found acceptance in an academic journal<sup>19</sup>.

<sup>18</sup> Molly How, Senior Nurse Clinician (Speciality Care), Infection Prevention and Epidemiology.

<sup>19</sup> Wee LE et al. Containing COVID-19 in the emergency department: the role of improved case detection and segregation of suspect cases. *Acad Emergency Med* 2020;27:379.

## Preparing the isolation ward

In early January 2020, ID doctors were already discussing with the IW nurses the possibility of an epidemic caused by the novel virus.

As the Senior Nurse Manager (SNM) of the IW, Ziyadah<sup>20</sup> had long experience working with the ID team and crafting a response to crises caused by emerging viruses in other countries.

This time, however, it felt different.

### Protecting patients

It was decided that the usual isolation patients, such as those with tuberculosis (TB) or chickenpox, had to be separated from these suspects to prevent cross infection. Nursing suspected cases for emerging infections presented a different set of challenges for Ziyadah. “I decided to split all the isolation nurses into two teams. We also have a small isolation area in



Nurses who oversaw the isolation wards – (from left) SNM Ziyadah, SNM Suriana bte Sanwasi and Nurse Clinician Ding Xiu Hui, guided by Deputy Director Nursing Norhayati binte Ahmad.

<sup>20</sup>Ziyadah binte Zainuddin, Senior Nurse Manager, Ward 68 (Isolation).

ward 58<sup>21</sup>, so I decided that nurses in ward 58 would operate on a different roster from nurses in ward 68. We could not afford cross contamination. This plan also meant I could transfer most of the usual isolation patients to ward 58. It was lucky that we did this – MOH quarantined five of my nurses, because they had been exposed to our second patient<sup>22</sup>, when he was still hovering about outside his father's room.

“As it was the eve of CNY, there was already a shortage of manpower. The majority of the nurses on duty were not Mandarin-speaking and they faced a language barrier trying to communicate with the influx of new admissions of tourists from China. The patients were frustrated and distressed at being confined in isolation. But the staff were helpful – they sought out mobile phone charging cables and provided international calling cards so that the patients could contact their loved ones.”

**Working in an IW can be terrifying. We can never be certain about the diseases that come knocking on our door. In mid-January 2020, we started receiving patients suspected to have that mysterious pneumonia from China. We were really worried about having enough stocks of PPE, including goggles and face shields. We sent our nurses for re-fitting to ensure they had the correct N95 masks. In a way, it gave them a sense of security.**

Muhammad Syafiq bin Abdul Manaf, Nurse Clinician,  
Ward 68 (Isolation)

<sup>21</sup> After SARS, a section of ward 58 was retrofitted to function as an isolation ward. Unlike ward 68 which is a purpose-built isolation ward, this is a no-frills isolation area, with negatively-pressured single rooms and dedicated staffing as the basic advantages.

<sup>22</sup> The son of the first COVID-19 patient also tested positive for the virus, and became SGH's second patient with the novel infection.



## STEPPING UP WITH MUM'S SUPPORT

The moment I touched down at Changi Airport on Day 3 of CNY, I got a call from my senior asking for volunteers at the IW. I had been home in Malaysia for the holidays. Before leaving home, I had reassured my mum, “Don't worry, I'm in Haematology. I'm very safe.”

In movies, people would want to be the hero and would readily volunteer their services. But when I was asked whether I would risk my life to do this, knowing there was no cure if infected, I hesitated. “Should I even do this?” I asked myself.

Then I thought, since I was living alone in Singapore, even if I got infected, there's less risk to others. Many of my medical officer (MO) friends were married or living with their parents. Initially I did not want to tell my mum because she had been really worried as my brother had just gone to China to be with his wife. I didn't want to add to her worries. But if I didn't tell her, I wouldn't be able to make up my mind to step up. I eventually called her, and she understood and agreed with my decision.

## Kiasu<sup>23</sup> Seniors Keep Us Safe

When I joined the team in the IW, I wasn't very sure whether or not I would be safe, but the ID department and our seniors really took great care of us. The senior consultants would check in with us every single day, to ask how we were doing. When we had to use the full PPE, they took great care to ensure that all our steps were correct.

After managing the first few imported cases, we thought the worst was over. We were then shocked to diagnose the illness in a local who had not travelled and who did not have a clear history of contact with a known case. Fortunately, our seniors had been very protective and made us wear the full set of PPE throughout. Honestly, we had thought they were over-reacting, being kiasu. But in the light of the newly confirmed patient, whom we had thought was of really low risk, we finally understood why they were so cautious. That gave me the assurance that we were working in a safe and well-protected environment.

## TAN SYE NEE

Resident, Internal Medicine

*Sye Nee was doing her Haematology posting as a junior doctor when she volunteered at the IW in the first few days of the outbreak.*

<sup>23</sup> A word used in colloquial Singaporean English. The Hokkien word means afraid to lose. It is almost always used metaphorically to refer to one who is “anxious not to lose out”.

## Moving the patient without breaking the cocoon

No patient should receive sub-optimal care just because of their isolation status. Yet, providing good care while adhering to infection prevention precautions was daunting. Scans have become an integral part of patient management in modern medicine. All too quickly, the inevitable had to be faced – scans that were indicated had to be performed, whether the patient was a confirmed or suspected COVID-19 case. Transporting them to Radiology Department had to become a fact of life, even in an epidemic. Moving such patients, however, would not be a walk in the park. Those from the ICU, with all the tubes, would be the most challenging.

## Clearing the path

ID physician Anson decided to draw up a protocol on a day when he was not “ID on-call for Pneumonia (China)”. Many people were involved in the logistics of patient transfer – Diagnostic Radiology, Environmental Services, isolation nurses, IPNs, security. Security had to clear the path – no one should accidentally come into the path of those suspected or confirmed to have the novel disease. The lift had to be controlled – the patient must not wait. Plans for possible collapse – “resuscitation points” – were also worked out along the way. To be extra sure, Anson conducted the dry run five times.

“Imagine four people looking like astronauts going into the lift with the patient who was connected via tubes to several machines. At that time, little was known about this virus, so on top of the N95 masks, we had to put on Powered Air-Purifying Respirators (PAPR). We went down to the



Moving very sick COVID-19 patients from the ICU to Radiology for scans involved a team of nurses, respiratory therapists, doctors and security staff.

details – where is the bed facing, where is the oxygen tank, who presses the lift buttons, who stands next to the patient in the lift. Only a few could get into the lift, so the rest of us would run up or down the stairs to get to the level before the lift arrived with the patient.

“Once, Security sent us so many officers that they must have been left with very few for other parts of the hospital. We needed six to transport an ECMO<sup>24</sup> patient to Radiology. This was a positive case. We could hear through their walkie talkies how frequently they communicated with each other. Security did an excellent job supporting us.”

<sup>24</sup>ECMO stands for ExtraCorporeal Membrane Oxygenation. This machine supplies oxygen directly to the blood in patients whose lungs are so injured even a ventilator can no longer push oxygen through.



### Preventing contamination

IPN Tan Kwee Yuen<sup>25</sup> checked out the scan rooms so that she would know what precautions to recommend. She noticed that CT scanners had many hard-to-reach joints that would be impossible to clean properly. She recommended that the scanner be plastic-wrapped before the COVID-19 suspect/patient arrived.

Her colleague Kamini Devi d/o Magesparan<sup>26</sup> came back to work on a Sunday when a COVID-19 patient needed an urgent CT scan. “It was my role to oversee the entire transfer process – watching over our staff to make sure that they stayed safe, that they were wearing the PPE correctly, and that there was no contamination during the transport from the IW to the Radiology Department.”

### Moving mountains for one patient

The ultimate test occurred when a COVID-19 suspect was diagnosed as having a heart attack and the patient had to go to the National Heart Centre Singapore (NHCS)<sup>27</sup> for cardiac catheterisation. Mounting the operation was a massive effort. Different resuscitation points were planned along the way. Yvonne paid tribute to the senior nursing staff. “The senior nurses, Sisters Ziyadah, Suriana<sup>28</sup> and Norhayati<sup>29</sup> came out in force to guide and coordinate with the Heart Centre – they helped with everything. Even though the transport was just 15 to 20 minutes, by the time the whole thing was finished, it was past 10:00pm. The three nurses were still in high spirits, and I was glad for their company.”

<sup>25</sup> Tan Kwee Yuen, Senior Nurse Clinician (Speciality Care), Infection Prevention and Epidemiology.

<sup>26</sup> Kamini Devi d/o Magesparan, Senior Staff Nurse, Infection Prevention and Epidemiology.

<sup>27</sup> NHCS and SGH are linked by an enclosed bridge for easy patient transport by wheelchairs or trolley beds.

<sup>28</sup> Suriana binte Sanwasi, Senior Nurse Manager, Ward 58.

<sup>29</sup> Norhayati binte Ahmad, Deputy Director Nursing.



Deputy Director Nursing Norhayati binte Ahmad (left) and Senior Nurse Manager Suriana binte Sanwasi arranging for a suspect COVID-19 patient to be transferred to the National Heart Centre Singapore for an emergency procedure.

### Making judgement calls

At the frontlines, the decision to admit a patient or to let him or her go home was no longer dependent solely on the patient’s need for hospitalisation. Letting people go home when they had a cough or a fever but who were otherwise well – a routine in the past – could mean seeding the community with a case of the novel virus. Junior doctor Lynn Ong<sup>30</sup>, then serving in the ED, described her internal turmoil.

“I got a call from the SGH Epidemiology team informing me that a patient I had seen the previous shift had tested positive. My thoughts ran wild as I racked my brain, trying to recall which patient had a telling history that I missed. It turned out to be someone with no risk factors apart from prolonged symptoms whom I had discharged after a swab, according to the latest MOH guidelines<sup>31</sup>. I tried to recall (to no avail) if I had done my hand hygiene and worn my PPE properly, and I could only place faith in my usual good practices. After that, even the slightest dryness in the throat in the morning triggered a flurry of anxious thoughts.

<sup>30</sup> Dr Lynn Ong, Medical Officer, Department of Emergency Medicine.

<sup>31</sup> MOH had a Swab and Send Home (SASH) policy, giving doctors guidance on the categories of patients who could be allowed to go home after a swab. Patients deemed to be of low risk were swabbed and then discharged home. They were instructed to isolate themselves until they received a call to inform them of a negative result.

“Then on another shift, I got a call from the Epidemiology team again. This time, it was a foreign worker with a week of cough and cold who tested positive. There had been some intermittent fever, but he was afebrile in the ED. Again, he fitted the ‘swab and discharge’ criteria.

“That’s missing two patients. I was devastated.”

## Closing a chapter – Patient 1 goes home

From the first two cases, we realised that this disease can manifest in different ways. The son was very well, didn’t have pneumonia like his father. Yet, the father got discharged earlier because the son kept testing positive. At that time, we did not know that while some people may still swab positive, they are actually no longer infectious.

Yvonne Chan, Associate Consultant, Department of Infectious Diseases

Nurse Syaheda<sup>32</sup> was one of those who attended to Patient 1 in the IW. “The patient was fearful, affected by his diagnosis. I tried my best to reassure him, despite a language barrier. I saw him hyperventilating as he read comments on social media blaming him and his family for bringing the virus to Singapore.”

<sup>32</sup> Nur Syaheda binte Abdul Aziz, Senior Staff Nurse, Ward 68 (Isolation).

Getting the first patient home was an elaborate affair. As viruses were known to survive on surfaces, there was much concern that his belongings would have live, infectious viruses on them. IPN Kwee Yuen decided that whatever could be wiped down with antiviral/antibacterial wipes would be wiped down. Whatever could not would be subjected to ultraviolet irradiation.

## Care continues outside the hospital

Medical social worker Vivian Chan<sup>33</sup> was involved in the discharge plans. “The patient, in his sixties, was travelling overseas for the first time. As he was discharged before his son, arrangements were made for him to be housed in a hotel. He wasn’t very savvy digitally, so I helped him set up a WeChat app on his phone. The nurses were concerned that he might feel lost so they gave him the phone number of the IW. I accompanied him to the hotel, and I noticed that the hotel staff were initially reluctant to assist him with his luggage. That night, the patient called the ward, informing them that his blood pressure (BP) was sky-high! He owned a BP set and had brought it with him to Singapore. The ward nurses asked the doctor on-call to assist him and advice was given over the phone. Not comfortable with what had happened, we decided to bring him back to the ward the next day. The staff checked his BP device and calibrated it against the ward’s BP set.”

<sup>33</sup> Vivian Chan, Senior Medical Social Worker, Department of Medical Social Services.

## Dodged the bullet in the heat of pandemic

The first patient agreed to an interview with the local Chinese newspaper Lianhe Zaobao. His account was reported on 20 February 2020 (the following excerpts are translated by SGH).

Mr Wang thought he could be discharged after three consecutive days of negative results, but the result returned positive on the fourth day, and he had to remain in hospital. Mr Wang said, "If the result had turned positive after I was discharged, wouldn't it be a bigger problem to the community? So, it was beneficial for me and responsible to the public that I stayed for a few more days."

Although he was in the hospital for 28 days, Mr Wang had fever only on the first three days and subsequently, just throat discomfort. His condition was more severe on the first two days, but did not require oxygen therapy.

Unfortunately, his son was also stricken with the disease and was Singapore's third confirmed case. The other eight family members continued with their trip, going on to Malaysia and four of them were subsequently confirmed to be infected. Mr Wang said, "I only knew that they were infected after they had been discharged. When I chatted with them on WeChat, they lied to me that they were well."

The meticulous care from the medical team also brought warmth to what became "the most unforgettable Spring festival<sup>34</sup>". Mr Wang said, "They were very caring, always offering words of comfort and asking if I needed anything. Although there was some language barrier, I could still feel their care and concern. I'm very impressed with their professionalism and sense of responsibility as they went about their work. They certainly have my respect."

On this trip to Singapore, which was also his first trip out of China, Mr Wang had only been to Sentosa. But he was thankful and felt that it was heaven's will that helped him escape an even worse fate had he been diagnosed with the infection back in China. "The situation in China is very complicated, too many patients, too few beds. I received very good care here and am very grateful to the medical team in Singapore."



<sup>34</sup> Chinese New Year is also referred to as the Spring festival in Mandarin.

## CHAPTER 2

# Rebuilding Fallen Walls

SARS was a wake-up call for a venerable institution like ours. Over the years, I could detect a palpable desire to do it right the next time there was an outbreak. You've got to view things through the lens of preparedness to understand, for example, why we built an X-ray room in a carpark. Yes, preparedness was always one of the reasons we could use to justify expenses. What is impressive is that it's not just the doctors and nurses who think like that, but many of our executives also instinctively know this — that whatever we do, it's important to be nimble in an outbreak.

### **SARS VETERAN**



## Writing the rules

SGH set up the Disease Outbreak Taskforce (DOTF) in the wake of SARS. Its main role was to develop policy and procedure for outbreaks. Every member of the taskforce had to come up with a step-by-step account of how his or her unit would respond to different scenarios. Clinic and ward supervisors had to list the steps they would take if they encountered a patient who fulfilled the definition of a “case” or a “suspect” of a novel infection. The details extended well beyond caring for the patient. How would the patient be transported to the Isolation Ward (IW)? What Personal Protective Equipment (PPE) would the porter wear? What equipment was needed to transport a patient’s specimen? How would senior management be updated of such an event? How would this be communicated to the staff and the public? These plans were made, reviewed and updated every three years.

Coordinating all these processes was the Preparedness and Response Department (PRD), set up in 2006 to take over a role that was previously rotated among staff in the Operations Division.

## Birth of an Infectious Diseases department

In 2003, there were only two specialist physicians and four advanced trainees in Infectious Diseases (ID), operating under the Department of Internal Medicine. In the aftermath of the SARS outbreak, several members of senior management favoured a full-fledged, independent ID department. At the very least, it would signal the hospital’s awareness of outbreaks and the role ID doctors could play in one. In 2008, after a long process of approvals, a Department of Infectious Diseases (DID)

was formally constituted. The corps of ID physicians had grown by then, with workload as the main justification. In 2020, former Chief Executive Officer (CEO) Ang Chong Lye<sup>1</sup> remarked that SGH had managed to build a “formidable ID team” over the years.

Although clinical volume was the *raison d’être* of the pioneering ID physicians, epidemic preparedness was always cited as one of the priorities. This was clear in a Medical Board paper proposing a stand-alone DID. “As a hospital that considers itself one of the leading regional centres, we should be prepared to receive a patient who arrives, ill, from an area with an outbreak of a highly communicable disease. Preparedness is a practical consideration as Singapore is an air and sea hub.”

It was recognised that senior ID physicians would play a pivotal role in preventing a repeat of the SARS crisis and they were inducted into the DOTF. There was also strong awareness of the importance of a good Infection Control team. The PRD, which acted as secretariat to DOTF, worked closely with the Head of DID to iron out details as plans were submitted by the different departments, to ensure that proposed policies consistently upheld the most important principles from an ID viewpoint.

### SARS IN SGH

The SARS outbreak in Singapore lasted from February to May 2003. 238 people were infected, 33 of whom died. Many of those infected were healthcare workers and their family members. In April 2003, SGH lost surgeon Alexandre Chao and health attendant Kiew Miyaw Tan. SGH had to close two wards and transfer 71 patients to Tan Tock Seng Hospital (TTSH). The Urology Centre and sections of the Radiology Department were also forced to close temporarily.

<sup>1</sup> Dr Ang Chong Lye, an ophthalmologist and a SARS veteran, was CEO of SGH from 2008 – 2017. During his tenure, the number of ID consultants in SGH grew steadily.

## Making space for an Isolation Ward

After the debacle of SARS, the cry for an IW in SGH rang loud and clear. Early in the SARS outbreak, it was decreed that six-bedded cubicles would only house one patient, for lack of dedicated isolation facilities. Industrial fans were placed at the windows to act as exhaust fans, creating makeshift negative pressure rooms. This arrangement quickly led to a bed shortage, and the multi-bedded rooms were then hurriedly retrofitted with temporary walls to turn the six-bedded cubicles into four compartments, each meant for one patient. These rushed arrangements were costly, yet fell short of infection control requirements.

The question that remained was where to site the IW. Physician Ng Keng Yeen<sup>2</sup> suggested using Block 6 level 8 and this idea was floated to senior management. This location then accommodated a staff canteen, a board room, a library and a medical students' lounge. While management bought into the idea, it took a lot of political will to see it through. Resistance came from all quarters, especially staff who valued their private space.



Lack of isolation facilities meant that SARS patients/suspects were cared for in general wards, with just one patient in a cubicle meant for six.

<sup>2</sup> Dr Ng Keng Yeen, Senior Consultant, Department of Gastroenterology and Hepatology.



Medical staff preparing to intubate a suspected COVID-19 patient in an isolation room in the IW.

The next problem was funding. Without any push from the ID team, hospital administration, led by then Deputy CEO Karen Koh<sup>3</sup>, looked out for funds and seized on a national call for strategic projects. The young ID team responded swiftly when asked to provide clinical input for the project, and funding was secured.

Although everyone had good ideas, no one in SGH had experience building a state-of-the-art IW. Ng Han Seong<sup>4</sup>, Chairman of Medical Board (CMB) at that time, felt that it was best to learn from hospitals abroad. He brought a small team on a study trip to Ditan Hospital in Beijing and the Princess Margaret Hospital in Hong Kong. Ditan was Beijing's response to SARS and Princess Margaret Hospital had just built a new isolation wing. Like us in Singapore, the Chinese and Hong Kong authorities had been badly hit by SARS. This prompted them to put money and resources into preparing for the next epidemic. These study visits provided the team with many useful insights.

<sup>3</sup> Karen Koh, Deputy CEO of SGH, 2003 – 2008.

<sup>4</sup> Prof Ng Han Seong, Emeritus Consultant, Department of Gastroenterology and Hepatology, was Chairman of Medical Board from 2006 to 2012.

The lessons of SARS informed many aspects of the design of the IW. In its current form, the ward has an Intensive Care Unit (ICU) that, in peacetime, mostly functions as a high-dependency area. No longer would the need for close clinical monitoring be an excuse for not isolating a patient. Patients with chickenpox or tuberculosis, infections transmissible by the airborne route, occasionally become very sick, requiring intensive care. By having an ICU located within the IW, such patients are able to receive appropriate high-level care without posing an infection risk to others. In addition to the dedicated ICU, every bed in the IW can double up as an ICU bed. This ability to ramp up capacity was built in because of the concern that a massive outbreak with a highly virulent virus would lead to a surge in the demand for ICU beds.

#### LEVELS OF INTENSIVE CARE

SGH, with its seven blocks, was built in the 1970s. It has multiple ICUs, but not all ICU beds are in single rooms. The concept of an area for “intermediate care” or “high-dependency care” evolved over the years, and multi-bedded pods were renovated to function in this manner, allowing for increasingly sophisticated care stratification. Each of these beds, for example, has the capability for continuous ECG monitoring. While these facilities were developed with clinical needs in mind, infection control had not been prioritised in the design.

After SARS, everyone instinctively understood that an isolation area would require ICU beds, with each bed in a single room. It was also clear that appropriate air engineering was essential, so that staff could work safely. While isolation ICUs enjoyed widespread buy-in, the need for an “isolation intermediate care area” was not similarly appreciated initially. Catering for such zones was in itself another struggle requiring intense negotiations for the necessary resources.

## Nurturing a team

Building a cohesive team of IW nurses was a slow process. Nurses had to be trained in the principles of infection control, and cross-trained to manage both surgical and medical patients. It was recognised that a few senior nurses needed training in the running of such a ward. Phuah Gaik Kheng<sup>5</sup> became the first nurse who was not previously working in Infection Prevention (IP) to receive funding to train abroad. It was remarkable as she took up the challenge at the age of 54! She became the first Senior Nurse Manager (SNM) of the IW. Suriana binte Sanwasi<sup>6</sup> was next. Although Suriana was no longer in charge of the IW in 2020, management tapped on her to guide other nurses who had to convert their wards into isolation facilities as cases surged.

Initially, few nurses wanted to work in the IW and morale was low. To make matters worse, there was a need for nurses with a range of sub-speciality skillsets because patients requiring isolation could originate from any speciality department. The Nursing Division supported the endeavour by sending nurses into the ward, but it took leadership and tremendous effort to turn the motley crew into a good team. To build camaraderie, the fledgling DID scraped from its meagre departmental funds to support annual Christmas and Chinese New Year celebrations at the ward. ID physicians would turn up at such functions to share light-hearted moments with the nurses.

<sup>5</sup> Phuah Gaik Kheng joined SGH in 1983 and worked in the ICU before the isolation ward. After retiring as a nurse in 2019, she continued in SGH as a Senior Patient Experience Manager.

<sup>6</sup> Suriana binte Sanwasi, Senior Nurse Manager, Ward 58.



## Never let a crisis go to waste

In 2015, SGH was once again shaken by a virus. A cluster of acute Hepatitis C infections in the renal transplant ward announced the arrival of another outbreak. When the hospital reported the outbreak to the Ministry of Health (MOH), and then went public, it found itself swirling in negative publicity. MOH convened a Committee of Inquiry to investigate the root causes and SGH's leaders stood once again in the firing line as they faced the press. Although the Committee was unable to pinpoint the exact cause of the outbreak, several lapses in infection prevention were identified.

### HEPATITIS C OUTBREAK

The Hepatitis C outbreak in 2015 affected 25 patients in the renal wards and was linked to eight deaths. Twenty of the patients were kidney transplant recipients.

Although the Hepatitis C outbreak largely affected only one department, it led to an extensive internal review of all practices related to IP and Patient Safety. Infection Prevention Nurse (IPN) Molly How<sup>7</sup> felt that hospital management was sincere in wanting to elevate infection prevention practices. "Measures such as single-use vials and needleless connectors that we had long fought for became a reality. The needleless connector proposal had been rejected because of its cost. This time, CMB Fong Kok Yong<sup>8</sup> and CEO Ang Chong Lye supported the interventions. They said that preventing a needle-stick injury would reduce a ton of mental anguish for the person involved. Our salute to them."

<sup>7</sup> Molly How, Senior Nurse Clinician (Specialty Care), Infection Prevention and Epidemiology.

<sup>8</sup> Dr Fong Kok Yong, Chairman of Medical Board, 2012 – 2019.

The culture is now very different. Staff feel more encouraged to speak up. The number of emails and calls that I receive from staff has increased tremendously after the Hepatitis C incident. The crisis has taught me the importance of being open – open to admitting mistakes and open to learning from mistakes.

Lee Lai Chee, Assistant Director Nursing (Specialty Care),  
Infection Prevention and Epidemiology

## Daily grind, tall order

When Molly joined the then Infection Control team in 2000, there were six other nurses led by microbiologist Ling Moi Lin<sup>9</sup>, who served as the hospital's Infection Control Officer on a part-time basis. Molly remembered that SARS was a taxing time. "There were so few of us, but so many things to do. We had to do mask-fitting, infection control training and answer all the queries coming in. We had to visit the wards often to check that infection control practices were in place. Luckily, Nursing pumped in manpower for the audits."

<sup>9</sup> Dr Ling Moi Lin, Director, Infection Prevention and Epidemiology, SGH. She was appointed to the same role for the SingHealth cluster during COVID-19.

Building an IP team took many years. There was a relentless increase in the types of multi-drug resistant organisms worldwide, and many were detected in Singapore's hospitals soon after, and sometimes before, they were characterised. Hospital leadership followed these trends with as they were updated on the rise of superbugs within SGH.

Moi Lin and her IPNs formed a team of dedicated professionals who devoted themselves to the many difficult tasks associated with infection prevention — running hand hygiene campaigns, performing audits, instituting policies, measuring infection rates. A physician commented in late 2020, "The battle against the superbugs was hard to win, but the efforts of the infection prevention team paid off during the pandemic. As far as I know, no staff passed COVID-19 to a patient and no staff caught COVID-19 from a patient."



Ling Moi Lin at the Command Centre. She heads the Infection Prevention and Epidemiology teams at SGH and SingHealth.

## Fever screening area in a carpark

For pandemic preparedness, MOH required each hospital to have a fever screening area (FSA)<sup>10</sup> that was sited away from the Emergency Department (ED). This would be used during outbreaks to decongest the casualty department. SGH welcomed the idea. The fever zone in the ED was small. When a new multi-storey carpark was being built on the SGH campus in 2013, PRD and a team that included ID physicians and IPNs hit on the idea of siting the FSA there.

Then Chief Operating Officer (COO) Loh Yong Ho<sup>11</sup> was supportive. Placing tents during an emergency in an open-air carpark was not tenable because proper facilities would take too long to set up. The option of converting space used for patient services, when needed, was considered potentially disruptive. Driven by a sense of purpose and urgency, SGH used its own funds to retrofit the carpark for FSA purposes.

Over the course of six months, SGH added

- a staircase for staff in the middle of the carpark to allow separation from incoming patients;
- a lead-lined room for an X-ray facility;
- staff toilets and shower facilities;
- store rooms on every level where recycled furniture could be stored for FSA use; and
- walls and shutters so that office spaces could be quickly set up with the necessary air conditioning ducting in place.

<sup>10</sup> For more details about the FSA, see Chapter 4.

<sup>11</sup> Loh Yong Ho, Chief Operating Officer, 2010 – 2018.



Having a lead-lined room at the multi-storey carpark enabled SGH to quickly move in X-ray equipment to set up the Fever Screening Area there in February 2020.

When it was ready in early 2015, PRD organised four drills that same year to test the facility and its own workflow. A second cycle of exercises was held in 2019. To prepare staff for the drills, PRD put together briefing materials about the workings of the FSA and uploaded them on the intranet. With each rehearsal, these documents were amended to incorporate lessons learnt. The briefing materials came in handy during the COVID-19 outbreak when training was needed for staff deployed from various areas of the hospital to the FSA.

Jorin Ng<sup>12</sup>, who joined PRD in 2010, had cut her teeth planning the hospital response to business continuity and mass casualty incidents. While working with many departments to put the plans together, she could visualise the scenarios such as a fire in the ward and understood the required changes to work processes. But planning for disease outbreaks proved very different.

<sup>12</sup> Jorin Ng, Senior Manager, Preparedness & Response, Crisis Planning & Operations Department.

“It is difficult to know what is going on because we can’t see the virus and sometimes we don’t understand how it behaves. COVID-19 has really been an eye-opener for me. When the call came to activate our FSA, I had mixed feelings. On one hand, we had always hoped our plans would never be put to use. Yet I couldn’t help feeling grateful that all the effort had not been in vain. I was excited at this true test of all our plans, but also relieved that we had done the preparations.”

## Imaging safely

While it was natural for ID physicians and IW nurses to take upon themselves the task of preparing for a future pandemic, the enthusiasm with which the Department of Diagnostic Radiology (DDR) embraced epidemic preparedness needed explanation. Unsurprisingly, their fervour had its roots in SARS<sup>13</sup>. Radiologists Chan Lai Peng<sup>14</sup> and Tan Bien Soo<sup>15</sup> knew that “cross transmission had occurred in the bowels” of their department – a painful but defining event.



Staff attending to a suspect COVID-19 patient undergoing a CT scan.

<sup>13</sup> Health attendant Kiew Miyaw Tan had caught SARS while attending to a patient in DDR. She was one of two SGH staff who passed away during the SARS outbreak.

<sup>14</sup> Dr Chan Lai Peng, Head and Senior Consultant, Department of Diagnostic Radiology.

<sup>15</sup> Dr Tan Bien Soo, Senior Consultant, Department of Vascular and Interventional Radiology.

After SARS, there was a need to change both process and infrastructure to face the next outbreak squarely. Inpatient and outpatient imaging facilities were segregated. Negatively-pressured rooms for general radiography, ultrasound, Computed Tomography (CT) and Magnetic Resonance Imaging (MRI) were installed. When the Division of Radiological Sciences was constituted, with Bien Soo as Chairman, a thorough review of practices was carried out with a focus on infection prevention. An internal task force was set up in 2018, in collaboration with colleagues from ID and Infection Prevention and Epidemiology (IPE). Through audits, the task force helped identify several areas of improvement in infection prevention, which radiology staff worked hard to implement. When the pandemic struck, the team was glad that they had taken the lessons gleaned from SARS seriously.

## Rehearsing to avoid regret

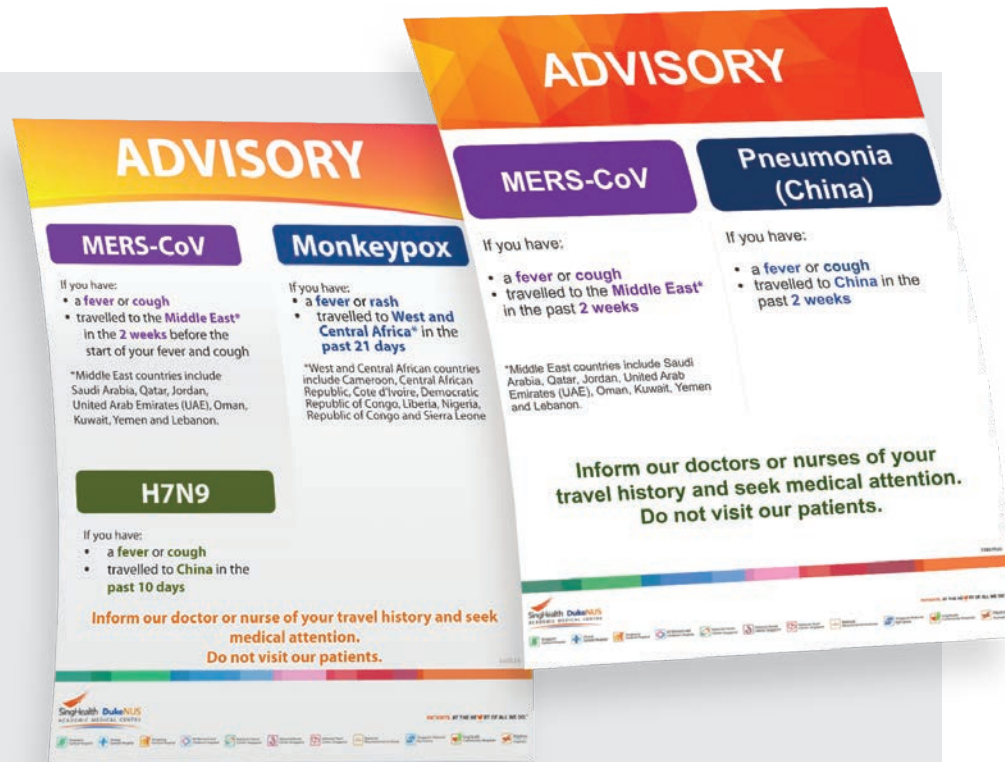
The Middle East Respiratory Syndrome (MERS) coronavirus was first identified in 2012 in a patient in Saudi Arabia. It rapidly demonstrated human-to-human spread and outbreaks in healthcare institutions were soon reported across the Middle East. The news of this novel coronavirus with a propensity for intra-hospital spread sparked alarm in SGH. There was grave concern that a case might slip into our wards.

One critical decision made by the DOTF was that anyone who had been to the Middle East recently and who had respiratory symptoms had to be admitted to the IW first and tested for MERS. The technical wizards in the Molecular Laboratory quickly developed a PCR<sup>16</sup> test for MERS. As air traffic was high between the Middle East and Singapore, this single decision enabled many of DOTF's plans to be tested regularly. Junior doctors became adept at taking throat swabs. Nurses and porters also became familiar with the process of handling the swabs for safe transport to the laboratory. These processes were easily replicated when H7N9 influenza and Ebola became outbreaks of concern.

The principle, instinctively understood, was that a potential case had to be identified at the very door of SGH and not after they got into the system. Hence it was decided that everyone coming to the clinics or to the wards had to complete a declaration form prepared by PRD. Visitors and patients had to declare if they had symptoms such as fever, cough or breathlessness. They also had to declare if they had been in the Middle East in the preceding two weeks. To ensure that visitors, patients, and accompanying persons had adequate warning that such screening would take place, posters were placed at strategic locations.

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<sup>16</sup> Polymerase chain reaction (PCR) tests detect genetic material. These tests are able to detect minute quantities of genetic material. The interpretation of PCR test results requires expertise and experience.



These posters at the entrances of SGH were constantly updated to reflect the infectious diseases in circulation. From left – May 2019 and January 2020.

These posters became a familiar sight at the hospital's entrances. They served as constant reminders to the staff of the danger of emerging infections, since every entry point had to develop protocols to deal with people who answered "Yes" to any of the questions on the declaration form. The ED had no problems with these, as they had been operating a fever zone for years. DDR also eased the needed processes comfortably into their workflow. However, the outpatient clinics had to develop new routines. Clinic managers pooled resources to keep one consultation room empty every day, so that any patient identified as being at risk could be ushered into it without delay, to be attended to under isolation conditions. This also meant that every clinic maintained a small supply of PPE.

In April 2013, news of human cases of H7N9 influenza emerged from China. The posters were rapidly updated. This ensured that persons who had been to either the Middle East or to eastern China were kept apart from the rest of the public from the moment they entered SGH. With the West African Ebola crisis of 2015, the travel questionnaire was amended yet again. With each outbreak of concern, the Communications and PRD teams, which produced the posters and screening forms, needed less guidance from the ID physicians. Once the email exchanges began among members of the DOTF, they needed no reminders to ensure that the posters and questionnaires reflected the latest concerns.

## Drills are for real

The seriousness with which a few SARS-scarred ID physicians took their epidemic preparedness work did not always go down well with the rest of the staff. One junior ID physician felt that outbreak preparedness and drills seemed "over the top, encroaching on the doctors' and nurses' burgeoning schedule".

In 2014, when the Ebola virus outbreak in West Africa occurred, despite the low number of African patients here, drills started. The ID team, the IW nurses and the ICU team all had to undergo training on donning and doffing of PPE under the watchful eyes of the IPNs. The transfer of suspected cases from the ED to the IW was also rehearsed.



## PUT TO THE TEST

In October 2014, an African businessman arrived in SGH with fever, nausea and vomiting. Because he was from Kenya (not Guinea, Liberia or Sierra Leone, which were the epicentres of the Ebola outbreak), he did not fulfil MOH's definition of a suspect case. However, he had recently visited Ghana in West Africa. It was a "grey case", a forerunner of many of our COVID-19 suspects today. It was a tough call to activate the Ebola drill, but on hindsight, I am glad that our leaders did. This involved more than just recalling one ID specialist back to hospital at night. Our department's roster had to be reshuffled in the middle of the night as I would not be allowed to work outside the small Ebola zone of the IW.

When I arrived in the ward, the nurses were ready, and my head of department, Tan Thuan Tong<sup>17</sup>, was already there. A final refresher of the protocols, and we were all set. The patient arrived soon after. He looked miserable with a vomit bag beside him. I thought, "Wow, this guy is alone in a foreign land, feeling miserable, and is now surrounded by healthcare workers, dressed like aliens in yellow gowns. And he's not even from one of the affected countries."

Planning of the consult was rehearsed mentally before entering the patient's room to minimise the steps needed to collect the necessary information. Within the constraints of space and the physical discomfort of the PPE, essential tests had to be performed, and this patient had to feel treated like a human being. What would routinely take 20 minutes now took more than an hour, and every step that I took was watched like a hawk by the IW nurses, who knew the drill by heart. iSTAT<sup>18</sup> was performed for basic biochemistry, and the results were transcribed on a piece of paper which would never leave the patient's room. I held it up against the window pane and there was a nurse on the other side copying the results. Additional blood specimens were collected, double bagged and wiped down. And the Ebola diagnostic test was stored in a container which I

<sup>17</sup> Dr Tan Thuan Tong, Head and Senior Consultant, Department of Infectious Diseases.

<sup>18</sup> The iSTAT machine is a portable device that can perform simple tests like blood counts and renal function.

thought appeared bomb proof and fit for the secret services of the world, ready to be delivered to the designated lab in the wee hours of the morning.

When the consultation was complete, we stepped out to the clean area for clinical documentation, administrative phone calls, and then we waited in our zone, demarcated from the rest of the ward. The other nurses made sure we were fed and brought us items we needed. We did not cross the line, and remained in our Ebola zone.

While waiting in the quiet, I reflected on the whole journey. During the encounter, I had caught a look of irritation in the patient's eyes. He had come to hospital to seek treatment, only to be shipped off to an isolation zone, have his personal belongings removed, and fussed over with an almost total loss of independence. Throughout that long night, we watched him through the glass double doors of his room. Fortunately, he remained stable and eventually tested negative for Ebola. He was diagnosed with malaria and made a full recovery.

This episode made me realise that the drill must happen over and over again to prepare our staff, test our processes and help us improve. But beyond getting the steps right to prevent harm to ourselves and the public health, it is about our duty to treat the patient as a person with dignity.

### JASMINE CHUNG

Consultant,  
Department of Infectious Diseases

IW nurse Ziyadah binte Zainuddin<sup>19</sup> commented that the Ebola drills were treated with great importance. “Anyone who missed a training session had to attend a make-up session and ICU nurses had to be similarly trained. Training was also held for all ID and ICU doctors. A handful of junior ID specialists had to demonstrate competency in blood taking and the use of the iSTAT machine.”

Nurse Muhammad Syafiq bin Abdul Manaf<sup>20</sup> took on the role of Ebola champion. “The training was rigorous – donning and doffing of PPE, admitting suspected or confirmed Ebola cases from the ED, extracting a suspect case from other wards, assisting doctors in collecting blood specimens, managing waste and managing death. All aspects were covered.”

**When COVID-19 started, I was  
deeply grateful for all the Ebola  
training we had in the ward.**

Teresa Cassandra Andrew, Nurse Clinician,  
Ward 58 (Infectious Diseases)

<sup>19</sup> Ziyadah binte Zainuddin, Senior Nurse Manager, Ward 68 (Isolation).

<sup>20</sup> Muhammad Syafiq bin Abdul Manaf, Nurse Clinician, Ward 68 (Isolation).

—•—

*At the battle of SARS,  
For each life lost  
We mourned  
But learned  
through ATTRITION.  
Analysed, dissected,  
Remembered the LESSON.  
Keep the faith alive  
So we can fulfil  
The mission of  
our CALLING.*

—•—

**WOO KENG THYE**  
Emeritus Consultant,  
Department of Renal Medicine

*Prof Woo was Chairman, Division of Medicine, during the SARS outbreak.*

## CHAPTER 3

# Staying Ahead Of The Curve

Evaluating a febrile cancer patient is bread and butter for an Infectious Diseases (ID) physician, but when I started typing, I froze. I had interviewed and examined him mechanically, but as I entertained the diagnostic possibilities, I started trembling. A few days earlier, we had just confirmed Singapore's first case of infection with the virus from Wuhan. Unsurprisingly, it was a tourist from the city. The patient I had just seen had certainly not travelled, but what if he had, just before his admission, hosted friends or relatives from China? What if he had a family member who worked in the travel industry? I had to ask him more questions.

But he was breathless and coughing. Was this the Wuhan pneumonia? I looked at the cancer patients in the room and all my hairs stood on end. I saw visions of SGH being castigated in the media for spreading the infection to a roomful of cancer patients.

After collecting myself, I made my clinical recommendations on the computer and headed to the next patient on my list. I told myself that none of us in SGH had done wrong – the patient<sup>1</sup> did not fulfil the Ministry of Health's (MOH) criteria for a suspect case. Although we had not broken any rules, my mind was racing with all the what ifs. This time, I told myself, SGH would not experience intra-ward transmission. All patients with symptoms that were even vaguely suggestive of this novel infection had to be segregated till proven otherwise.

Fortuitously, I bumped into Chian Min<sup>2</sup> and voiced my concerns. He understood immediately. We discussed various ways of minimising the risk of contagion. A ward for patients with respiratory complaints would be a perfect solution. By luck, I also met Ghee Chee<sup>3</sup>, and was also able to sell my ideas to him. If a ward could be found, he was happy to have his staff man the ward.

We called them Acute Respiratory Infection (ARI) wards. We made the rules as we went along. In that electrifying early period, every day, Ghee Chee and I met the consultants running the first three ARI wards and discussed all suspicious cases. We were determined not to miss any case of the novel coronavirus infection. We read the daily MOH press releases no matter what time they came out. We picked out the workplaces of the day's confirmed cases. These were relayed through text messages to the ARI staff. Every new cluster site mentioned was incorporated into the electronic medical record system so that frontline doctors would not miss these out in the contact history. The first consultants of the ARI wards – Leong Chai<sup>4</sup>, Melvin<sup>5</sup>, Jenny<sup>6</sup> and Yuyang<sup>7</sup> – were true heroes. They worked uncomplainingly in areas that did not have the usual safety nets of a purpose-built Isolation Ward (IW).

### TAN BAN HOCK

Senior Consultant,  
Department of Infectious Diseases

<sup>1</sup> This patient was eventually confirmed not to have COVID-19.

<sup>2</sup> Dr Loo Chian Min, Chairman, Division of Medicine and Senior Consultant, Department of Respiratory and Critical Care Medicine.

<sup>3</sup> Dr Phua Ghee Chee, Head and Senior Consultant, Department of Respiratory and Critical Care Medicine.

<sup>4</sup> Dr Leow Leong Chai, Senior Consultant, Department of Respiratory and Critical Care Medicine.

<sup>5</sup> Dr Melvin Tay, Senior Consultant, Department of Respiratory and Critical Care Medicine.

<sup>6</sup> Dr Jenny Hsieh, Associate Consultant, Department of Internal Medicine.

<sup>7</sup> Dr Tan Yuyang, Consultant, Department of Internal Medicine.



## SHADOW-BOXING AN UNKNOWN ENEMY

News of the horrifying extent of the outbreak from Wuhan filtered through to us from multiple sources, but what stuck in my mind were personal stories and terrible experiences from frontline workers in China describing the severity of the outbreak and the toll it had taken on them physically and mentally.

We read constantly to try and keep up with the barrage of news and literature updates as it was crucial for our job. We had to know where the latest hotspots were, what occupations were now more at risk, which nationalities were more likely to be affected, and update our daily history-taking template accordingly. We had to know what the latest research was showing. Was the virus airborne? How long did it survive on surfaces? Could we risk-stratify patients based on biomarkers? The daily sharing sessions led by senior ID physicians were instrumental in distilling and spreading information to our teams. We then modified our workflow accordingly. If it didn't work well, we tried something else. It was both refreshing and exhilarating at the same time.

Whatever concerns or fears that I had at the beginning were put to rest once the actual work started on the ARI wards. I knew that I had a good team of junior staff. The young doctors worked extremely hard to cope with the high daily numbers of admissions and discharges that came through the ARI wards. They looked out for each other all the time, from making sure that everyone's Personal Protective Equipment (PPE) was put on properly to checking that swabs were taken in a safe and timely manner to meet the tight timelines. This was crucial for ensuring that beds were freed up for the new admissions<sup>8</sup>. The juniors covered each other constantly, for meals, breaks and calls. We joked to keep our spirits buoyant and to distract from what was happening to frontline healthcare workers in Wuhan. The enthusiasm, commitment and competence that they demonstrated, in responding to this unknown and potentially deadly situation, really impressed me and made me feel silly for having had doubts and fears.

**There was not a single murmur of complaint or unhappiness from the young doctors. In fact, it was the opposite; they were even fighting to volunteer when the need arose.**

Leow Leong Chai, Senior Consultant, Department of Respiratory and Critical Care Medicine

<sup>8</sup> Patients were discharged from the ARI wards only after they had tested negative for the virus at least twice. Reports indicated that people presenting very early in the illness might not yield positive swab results, so the swabs had to be done on different days, and the interval between swabs varied depending on the clinical presentation.

## Creating new workflows

There was no blueprint or standard operating procedure for the ARI wards, so the teams had to fly the plane while building it. The purpose and objectives were clear – to look for and limit possible spread of infection. Each zone was manned by a dedicated team, 24/7, that would not work elsewhere.

But there were problems aplenty. When the ARI teams requested sub-speciality consults, some specialists required the patients to be tested negative for the virus two times over before reviewing them. Others insisted on the patients being cleared and transferred to a “safe” ward before evaluation. When procedures needed to be done in another part of the hospital, transporting the patient under full infection control precautions was an exercise in patience and endurance because of the need for strict attention to detail. Thankfully, the hospital Command Centre was unwavering in its support. ID physicians Limin Wijaya<sup>9</sup> and Chua Ying Ying<sup>10</sup> were indefatigable – negotiating patiently with multiple departments to develop protocols to smoothen the workflow.



ID physicians Chua Ying Ying (left) and Limin Wijaya in deep thought during a quiet moment as they worked tirelessly to integrate processes across the hospital.

<sup>9</sup> Dr Limin Wijaya, Senior Consultant, Department of Infectious Diseases.

<sup>10</sup> Dr Chua Ying Ying, Senior Consultant, Department of Infectious Diseases.

### THE PURPOSE OF THE ARI WARDS

All official definitions, from MOH, the World Health Organisation (WHO) and the US Centres for Disease Control and Prevention (CDC), for a suspect case of the novel infection combined symptoms with epidemiologic exposures. Thus a person with cough was a suspect only if he or she had been in contact with a known case of the novel coronavirus infection, or had travelled to an area experiencing community transmission of the infection.

The ARI ward, on the other hand, was meant for persons who had suggestive respiratory symptoms but no known epidemiologic exposure, or whose exposures were considered remote. Such persons could only be infected if they had been exposed to asymptomatic intermediaries, and then only if asymptotically infected persons were capable of transmitting the virus. This would soon become fact, but in late January 2020, it was based only on a statement from a spokesman for the Chinese government, as reported by China Central Television and the local media on 26 January 2020.

The ARI wards formed an isolation zone for people who fell through the cracks of the official definitions of a suspect, as illustrated by the patient described below. In this case, the patient herself had not visited the church, and her sister was not yet proven to have the infection.

ID physician Tan Ban Hock recollected. “One Sunday morning, a few days after we had opened the ARI wards, Leong Chai brought up a patient for discussion. She had prolonged symptoms of a respiratory tract infection as well as lymphopenia<sup>11</sup> on the blood counts. He dropped the bombshell in his next sentence – the patient’s sister frequented the church at the centre of Singapore’s then-largest cluster and had been admitted to Tan Tock Seng Hospital a day or two before. The patient was moved promptly to an IW and her roommate was not allowed out of that room till multiple tests adequately excluded the infection in both of them. Once again, we had to develop the rules according to the circumstances. But soon, a true positive was found in the ward. They were uncommon, but every case reminded us that there was no room for complacency.”

<sup>11</sup> A deficiency of lymphocytes, a type of white blood cell. Lymphopenia was recognised as a feature of the novel infection very early on. Lymphopenia is not unique to COVID-19, but in the correct setting, it is a clue to the diagnosis.

## Staying true to the purpose

As worries about unwittingly missing a case grew, more and more patients were admitted to ARI wards and the number of wards had to be expanded. In each ARI ward, the number of beds per cubicle was reduced and this impacted hospital bed capacity. Designating a new ward as an ARI ward meant complex logistics and administrative challenges. The ARI proponents received untiring support from a steadfast team of administrators – the unseen and unheard – who oiled a growing machine that had sprung from the scars of SGH’s painful experience with SARS. This backroom team became the Division of Medicine’s Preparedness and Response capability – Ratna binte Abdul Rahman<sup>12</sup>, Grace Kwek<sup>13</sup>, Ang Yilin<sup>14</sup>, Ho Wanqi<sup>15</sup> and Tan Shuxian<sup>16</sup>.

Sometimes, an ARI ward opened the next day or on a Friday evening. There would be a mad scramble to change the roster of the Division of Medicine. Luckily, every time we called a Head of Department, he or she would agree. We had to know which doctor had failed mask-fitting – they could not be assigned to the IW or ARI wards. Because things happened very fast, all of us were checking our phones all the time, day and night, even on weekends. Many people may not think much of medical administrators, but after COVID-19, even our family members realised that medical administrators mattered too.

Ang Yilin, Senior Executive, Division of Medicine

<sup>12</sup> Ratna binte Abdul Rahman, Senior Manager, Division of Medicine.

<sup>13</sup> Grace Kwek, Senior Executive, Division of Medicine.

<sup>14</sup> Ang Yi Lin, Senior Executive, Division of Medicine.

<sup>15</sup> Ho Wan Qi, Healthcare Management Executive.

<sup>16</sup> Tan Shu Xian, Senior Executive, Division of Medicine.

### IMPACT OF THE ARI WARDS

From 5 February to 18 March 2020, 446 patients fulfilled MOH's criteria for a suspect case and were admitted to our IW – 15 of these tested positive for the novel virus. During the same period, 1,178 patients were admitted to ARI wards – five were tested positive. Although the yield appeared low, SGH stalwarts (SARS veterans in particular) recognised the positive impact of the ARI wards. We had prevented five clusters from forming in Singapore.

What could have been worse was that those clusters could have formed within SGH wards, spreading infection to staff and to vulnerable patients. The repercussions on staff morale and hospital reputation were unthinkable. The destination, though clearly not final, was (in the words of an old song) nevertheless worth the while.

These data from the statistical analyses performed by the ARI pioneers were published in an academic journal<sup>17</sup>.

### You can't do without nurses

As always, nurses were indispensable. Nurse Nanthakumahrie d/o Gunasegaran<sup>18</sup> was tasked to convert and man ward 65B as an ARI ward. She recalled the early problems. "It was a real challenge to work with different nurses, all coming from different wards, with vastly different experiences in infectious disease management. The spectrum ranged from novice nurses who had worked for less than a year, to those from the neonatal units and operating theatres, who had not worked in an acute adult ward for years. Not having healthcare assistants added to the challenge. Everyone rolled up our sleeves and learnt from each other."

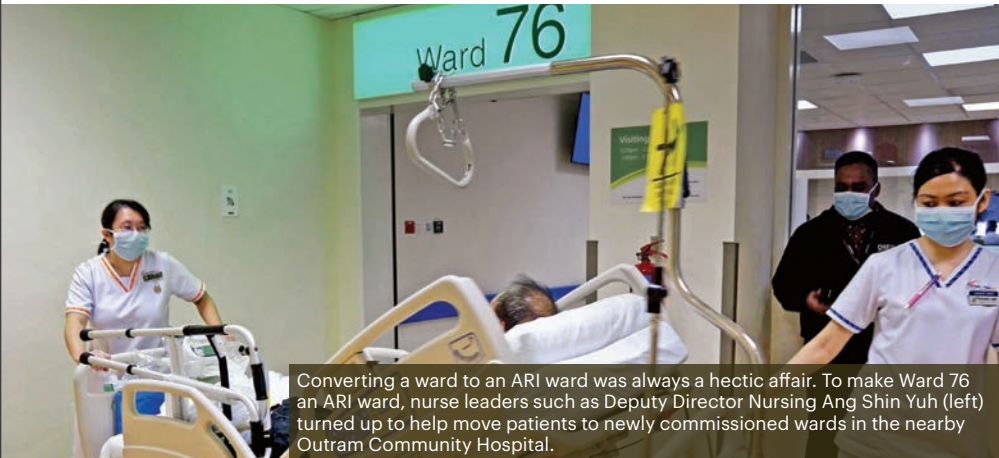
<sup>17</sup> Wee LE et al. Respiratory surveillance wards as a strategy to reduce nosocomial transmission of COVID-19 through early detection: the experience of a tertiary-care hospital in Singapore. *Infect Control Hosp Epidemiol* 2020;41:820.

<sup>18</sup> Nanthakumahrie d/o Gunasegaran, Nurse Clinician, Nursing Research.

The overwhelming majority of patients admitted to ARI wards were not anticipated to have the novel infection. Therefore, multi-bedded cubicles continued to be used, though with fewer beds in each cubicle to increase the distance between the patients and to minimise the number of people exposed, should a patient turn positive. When the diagnosis of infection was confirmed in such a multi-bedded cubicle, any patient who shared the cubicle was designated a Person Under Quarantine (PUQ). PUQs had to be carefully managed. If they still required inpatient care, they had to be transferred to a single room, preferably in an IW. If they were fit for discharge, they had to be quarantined according to national guidelines. The discharge process had to be carefully coordinated, and SGH soon had a small platoon dedicated to the tedious liaison with various external parties to ensure that discharged PUQs got to their place of quarantine safely without potentially infecting anyone else.



Staff in ARI wards delivering care were mindful of the risks of COVID-19.



Converting a ward to an ARI ward was always a hectic affair. To make Ward 76 an ARI ward, nurse leaders such as Deputy Director Nursing Ang Shin Yuh (left) turned up to help move patients to newly commissioned wards in the nearby Outram Community Hospital.

Nurse Kan Sook Han<sup>19</sup> was assigned to be the nursing manager of ARI ward 67. “We had to create an entirely new procedure for patients discharged to designated community care facilities. The scale of collaboration and coordination was enormous. This involved a multi-disciplinary team – the coordinator who liaised with MOH, doctors, nurses, security officers and medical social workers. Without the dedication of every single person, there would have been a great mess and every day would have been a mad scramble.”

Despite the careful planning, hiccups were inevitable. One patient, a PUQ, required home quarantine by national guidelines. He was in his mid-seventies, lived alone and could not cook. Officials from the various ministries had anticipated such a situation and the ward team was informed that a scheme for meal delivery could be activated. Still, the septuagenarian found himself without meals on his first day at home. Nurse Hartini binte Osman<sup>20</sup>, who was in charge of the ward to which he had been admitted, took it upon herself to rush over to his house with some dinner.

<sup>19</sup> Kan Sook Han, Nurse Clinician, Ward 45 (Respiratory Medicine).

<sup>20</sup> Hartini binte Osman, Senior Nurse Manager, Ward 73 (Internal Medicine).

## Identifying the enemy

The SGH Molecular Pathology Laboratory (MPL) was set up in July 2006. The initial vision was to consolidate molecular testing within the Pathology division. After SARS in 2003 and H1N1 in 2009, the MPL made preparations for the next pandemic. It was almost an obsession for the two molecular virologists, Chan Kian Sing<sup>21</sup> and Lynette Oon<sup>22</sup>, who always factored pandemic considerations into all their decision-making. In 2019, when the national stockpiles for laboratory reagents were dismantled, SGH maintained its own inventory. They had also put in place a streamlined respiratory swab processing protocol, and had purchased an automated liquid handler. These proactive steps to enhance the laboratory’s capability would prove prescient.

**The SGH Molecular Pathology Laboratory (MPL) was critical to Singapore’s response to COVID-19. They got out a new polymerase chain reaction (PCR)<sup>23</sup> test very quickly; they anticipated shortages in reagents and consumables and stockpiled in advance. They were among the first in the world to notice subtleties and idiosyncrasies of COVID-19 testing, and their expertise likely underpinned some of the frontline actions that led to SGH detecting cases that did not fit the existing MOH case definition at that time.**

Koh Tse Hsien, Head and Senior Consultant, Department of Microbiology

<sup>21</sup> Dr Chan Kian Sing, Senior Consultant, Department of Molecular Pathology.

<sup>22</sup> Dr Lynette Oon, Head and Senior Consultant, Department of Molecular Pathology.

<sup>23</sup> PCR tests detect the genetic material (nucleic acid) of micro-organisms and are generally considered the best test for picking up small quantities of micro-organisms.

On 30 December 2019, Lynette noticed a post on four cases of pneumonia of unknown cause on ProMED, a publicly available surveillance system that reports infectious diseases outbreaks around the world. A few days later, on 2 January 2020, MOH sent out a circular laying down the criteria for a suspect case of the novel infection and instructed that samples from such patients be sent to the National Public Health Laboratory (NPHL). On 8 January 2020, Chinese scientists reported finding from the affected patients a novel coronavirus, which was neither SARS-CoV nor MERS-CoV. At this point, the MPL knew that it was a matter of time before the virus found its way to Singapore and decided to develop a test for it.

The complete genome of the novel coronavirus was made publicly available on 11 January 2020. By 13 January 2020, real-time PCR protocols were published on the WHO website. Cases were reported from Thailand and Japan on 15 January 2020 – the urgency of developing a diagnostic test was growing. MPL ordered primers and probes on 17 January 2020 and Lynette harried the vendors daily to expedite delivery.

The plan was to first use ribonucleic acid (RNA) extracts of SARS-CoV, which MPL had archived from the old days, as positive controls for the PCR. The team of scientists and technologists, notably Lim Kun Lee<sup>24</sup>, Kenneth Chan<sup>25</sup>, Yau Ee Xuan<sup>26</sup> and Bryan Tan<sup>27</sup>, worked tirelessly to modify and validate the PCR assay so that it was fit for clinical use. On 23 January 2020, the PCR assay for the novel coronavirus was ready for clinical use, making MPL the first service laboratory in Singapore to offer this test.

<sup>24</sup>Dr Lim Kun Lee, Principal Medical Laboratory Scientist, Department of Molecular Pathology.

<sup>25</sup>Kenneth Chan, Medical Laboratory Scientist, Department of Molecular Pathology.

<sup>26</sup>Yau Ee Xuan, Medical Laboratory Scientist, Department of Molecular Pathology.

<sup>27</sup>Bryan Tan, Medical Laboratory Technologist, Department of Molecular Pathology.

The new test proved itself the very day it was first used – by detecting Singapore’s first case. The result came out at 2:30pm, and the NPHL confirmed the accuracy of the result by 6:00pm, with the news released by MOH to Singapore the same evening.

A senior ID physician shared his pride in the MPL. “One day, as I discussed the results of various viral PCRs while rounding on transplant patients, the medical officer asked me how I had managed patients in the primitive 1990s when all these tests were not available. We have indeed come a long way. I can look at international colleagues in the eye, because we in SGH have personal experience with the CMV, EBV and BKV PCRs<sup>28</sup>, and many more. We are familiar with their utility and limitations.”

**If we are a first-class hospital,  
it is because we have a first-class  
Molecular Lab and forward-looking  
molecular virologists.**

Tan Ban Hock, Senior Consultant, Department of  
Infectious Diseases

<sup>28</sup>Cytomegalovirus, Epstein-Barr Virus and BKV, which is a virus from the polyomavirus family.

## RACE TO DEVELOP A PCR TEST

**30 December 2019**

ProMED post on four cases of pneumonia of unknown cause in Wuhan noticed by SGH molecular virologist.

**2 January 2020**

MOH sent circular laying down criteria for a suspect case of the novel infection and instructed that samples from such patients be sent to the National Public Health Laboratory (NPHL).

**8 January 2020**

Chinese scientists reported finding a novel coronavirus from the affected patients.

**11 January 2020**

The complete genome of the novel coronavirus was made publicly available by Chinese scientists. It had about 80% genetic similarity with SARS-CoV which caused the SARS outbreak.

**20 January 2020**

MPL modified and validated the PCR assay to be fit for clinical use.

**17 January 2020**

SGH MPL ordered primers and probes. For positive controls, MPL planned to use RNA extracts of SARS-CoV from their archives.

**15 January 2020**

Cases were reported in Thailand and Japan. The urgency of developing a diagnostic test was growing.

**13 January 2020**

Real-time PCR protocols were published on the WHO website.

**23 January 2020**

The PCR assay for the novel coronavirus was ready for clinical use.

**2:30pm**

In its maiden run, the new test detected Singapore's first case of COVID-19, a patient from China admitted to SGH the day before.

**6:00pm**

The NPHL confirmed the result of the SGH test, and MOH released the news to Singapore the same evening.

## SECURING RESOURCES

With our new test, SingHealth<sup>29</sup> was able to keep ahead of the outbreak by detecting the virus in patients who did not meet the official case definition for a suspect case. On 4 February 2020, the first local cases (without travel history) were diagnosed in SGH. This development may have led to changes in the national criteria for calling a patient a suspect case.

After the diagnoses of the first few novel coronavirus patients in Singapore, our senior team met on 28 January 2020. We were then receiving about 40 samples a day from SGH and other SingHealth hospitals. With Europe and USA following quickly behind Asia in the growing outbreak, there was a narrow two- to three-week window to secure sufficient supplies of reagents and consumables before supply chain disruptions came into play. Our most important reagent was the RNA<sup>30</sup> extraction reagent produced in France. SGH had a small stockpile of this reagent which would have lasted a few months if the testing workload remained below 50 samples a day. However, the anticipated demand to support broader screening was estimated at 300 samples a day.

Manpower was another consideration. More staff were required to run these additional tests on top of routine clinical tests. Operating hours had to be extended. Extra medical technologists had to be found and trained at short notice. We reached out to the other laboratories in the Pathology division for reinforcements. Through the support of Division Chairman Tan Puay Hoon<sup>31</sup>, a reserve force appeared. This comprised volunteers from the laboratories of Diagnostic Bacteriology, Virology, Cytology, Immunology and Serology, Cytogenetics and Translational Pathology. Later in the outbreak, the Division of Research also provided researchers to assist with the PCR tests.

### LYNETTE OON

Head and Senior Consultant,  
Department of Molecular Pathology

<sup>29</sup> SGH is part of the SingHealth cluster, which comprises four hospitals, five specialty centres, community hospitals and a chain of polyclinics.

<sup>30</sup> Ribonucleic acid is the genetic material of the coronavirus. Purity and amount of the RNA extracted affect the performance of the downstream PCR tests.

<sup>31</sup> Dr Tan Puay Hoon, Chairman, Division of Pathology.

More space, preferably on another floor, was needed to implement the split team system so that a second team could continue doing the testing if the first team was stricken by the virus and had to be quarantined. A Virology laboratory was eventually repurposed to run PCR tests.

In early March 2020, MOH mandated further increases in national laboratory testing capacity and asked SGH to double its capacity to 600 samples per day. To manage the increase in specimens, SGH placed an order for three automated nucleic acid extractors but Germany then banned exports of all their extractors and restricted the use of the critical RNA extraction reagent to only Europe.

Kian Sing expressed his worries. “We realised there wasn’t any stockpile of the reagent. They were running so low that it was scary how many days of stock were left – nine days. There was now no point getting the new extractors.”



Shamala d/o Letchmanan, Senior Medical Laboratory Scientist, working in the MPL.

Lynette made frantic phone calls to other vendors. Only one vendor had the equipment in Singapore, but it was their demonstration unit. This was the instrument running the first FDA<sup>32</sup> approved SARS-CoV-2 PCR test in the market. It was almost fully automated, capable of a throughput of over 1,000 tests per day. The company was also willing to commit to providing the necessary reagents. There was a catch though – the equipment could not fit into the laboratory because of its size. Measuring 3 metres by 1.3 metres and weighing nearly 1,700 kg, it was a behemoth by laboratory standards. With a growing global waiting list for this instrument, the SGH team had to act fast to find a solution and secure this precious capability. Thankfully, the Immunology Laboratory provided their Immunofluorescence room to house the equipment.

**Within three months of the outbreak, we were processing up to five times more samples. Work was pouring in like torrential rain!**

T Shalini, Medical Laboratory Technologist, Molecular Laboratory



Bryan Tan, Medical Laboratory Technologist, was among the team who worked tirelessly to develop the diagnostic test for the novel virus for clinical use in January 2020.

<sup>32</sup>Food and Drug Administration of the USA, responsible for ensuring the safety and efficacy of drugs and medical devices.

The vendor started installing the instrument on 30 March 2020. With outbreaks in the dormitories escalating, validation of the test and training of staff proceeded at breakneck speed. Validation of the test was completed on 10 April, just as the avalanche of samples from the dormitories started. Over the next four months, the laboratory tested up to 1,100 samples a day from dormitories, community care facilities, polyclinics as well as SGH itself. The IT infrastructure was initially unavailable for the dormitory swab operations and hundreds of samples a day came in with handwritten patient details. Lynette was appreciative of the combined team effort. “The rest of the Pathology Division stepped in again – we soon had a platoon of clerical volunteers from our Client and Specimen Management colleagues and Division of Pathology administrative staff. This problem was finally fixed when informatics experts Goh Min Liong<sup>33</sup>, Pamela Tan<sup>34</sup>, and medical administrator Seah Waih Khuen<sup>35</sup> from Pathology came together to provide an automated end-to-end IT solution that enabled external patient details to be incorporated into our systems.”

### Round-the-clock testing

As the work piled up, and specimens kept coming in, the MPL ran tests continuously, day and night, for months on end. Help came from the Bacteriology Laboratory to run the overnight tests. Medical Laboratory Scientist Eileen Goh<sup>36</sup> appreciated that everyone chipped in during tough times. “We used to work a five-day week, taking turns on Saturdays when the lab opened for half a day. That changed in February 2020 when the lab started operating every day. All of us worked six days a week, taking turns on Sundays and public holidays. Some shifts focused solely on COVID-19, while other staff split their time between the COVID-19 virus and other viruses. Our entire Division of Pathology came together to help the nation in our COVID-19 battle.”

<sup>33</sup>Dr Goh Min Liong, Group Chief Medical Informatics Officer, SingHealth.

<sup>34</sup>Pamela Tan, Assistant Director, IT.

<sup>35</sup>Seah Waih Khuen, Senior Manager, Division of Pathology.

<sup>36</sup>Eileen Goh, Medical Laboratory Scientist, Molecular Laboratory.



## ERRING ON THE SIDE OF CAUTION

I was a third-year medical student when my seniors fought against SARS. I remember being wide-eyed as they recounted stories that reflected courage, selflessness and sacrifice. I was determined to emulate them.

As the world plummeted precipitously into uncertain times, I found myself exactly where my seniors stood – as one of the pioneer batch of consultants assigned to the ARI wards in February 2020. I went on to volunteer for a second month because I really enjoyed the camaraderie and wanted to ensure that the work processes were refined as much as possible before I handed over.

When I started in ward 75, I drafted an informal guideline for our team of Respiratory doctors on how to conduct ward rounds in a pandemic. I had been keenly following the Chinese medical literature, and what I read made me doubt the prevailing understanding of the virus' route of transmission, that is, via droplet only. A staff nurse shared with me anecdotes from her ex-colleagues in China – stories that spoke of an unusually contagious virus. I insisted that my team be more cautious. I shared our concerns with Sister Chiew<sup>37</sup>, the ward manager. She listened without prejudice and raised them to the hospital Command Centre promptly. Within days, the minimum PPE was escalated from surgical mask (with gown and gloves) to N95 masks.

Not long after that, the ward picked up the first COVID-19 patient within an ARI ward in SGH. The patient had slipped through screening as she had chosen to hide some critical information, but possibly because of all the precautions we took, none of us in the ward caught the infection from her.

### MELVIN TAY

Senior Consultant,  
Department of Respiratory and Critical Medicine

*Melvin diagnosed the first positive case in an ARI ward.  
He subsequently developed fever, but thankfully tested negative  
for COVID-19.*

<sup>37</sup> Chiew Siew Fong, Senior Nurse Manager, Ward 75 (Orthopaedics). She found herself running a medical ward when her ward was converted into an ARI ward.



Staff in the Acute Respiratory  
Infection wards delivered care  
mindful of the risks of COVID-19.

## CHAPTER 4

# Wind Beneath Our Wings

The Operations and other support teams brought a good grasp of the intricate workings of a hospital. Our Operations staff were not only fast to react, but also knew exactly what needed to be done. We are fortunate to have retained many old hands who have gone through previous disease outbreaks.

**TAN JACK THIAN**  
Chief Operating Officer

The drama at the vanguard of the COVID-19 battle – the very frontlines where patients are looked after – is at the heart of our mission as a hospital. But clinical acumen alone was not going to win the war. The efforts of less celebrated colleagues made the thrills at the bedside not only safe, but possible. This unseen army, cavalierly referred to as support or backend staff, verily waged the battle on diverse fronts, contributing to the many triumphs we enjoyed.

## The contact tracers

Infectious Diseases (ID) physician Indumathi Venkatachalam (Indu)<sup>1</sup> ran the contact tracing operations, starting with just a tiny Epidemiology (Epi) team, part of the Infection Prevention and Epidemiology (IPE) department. “Patients were not always willing or able to talk to us. Some were too ill. Some did not want to reveal their activities and interactions, misleading us and sending us off track. We had to revisit the events again when corroborative history did not match.”

Activity mapping and contact tracing<sup>2</sup> were not simple, straightforward processes. Yet they were integral to the COVID-19 disease control efforts and had to be ramped up quickly as the numbers were rising exponentially.

<sup>1</sup> Dr Indumathi Venkatachalam, Consultant, Department of Infectious Diseases and Consultant, Department of Infection Prevention and Epidemiology.

<sup>2</sup> Singapore eventually rolled out TraceTogether, a mobile phone app that enables user identities to be traced if the users are in close proximity with each other.



## GATHERING A TEAM TO RETRACE STEPS

We began as a team of four, interviewing cases, risk-assessing contacts, liaising with MOH, coordinating with clinical and administrative teams, and managing communications and data processes. We stood in the Emergency Department (ED) at 1:00am once, trying to identify contacts of an index case who had been there. We walked the corridors of the newly converted Acute Respiratory Infection (ARI)<sup>3</sup> wards to assess potential risks to staff and patients. We viewed the locker rooms and pantries where a COVID-19 positive staff<sup>4</sup> had been. We talked to nurses, doctors, cleaners and other staff to understand their interaction with index cases, to individually risk-assess, report, and sometimes, reassure.

We sought manpower to help. Could we outsource the work to them, some asked. But what exactly do we outsource, when rules and protocols change daily? Could we prioritise important tasks? But which tasks are important? And to whom are these important?

There were many things to consider. There was much that we did not know. We did not know who might be at risk, so we had to cast a wide net. We did not know all the ways the disease might manifest but had to develop ways to narrow the suspects, in case it was secretly lurking somewhere in the hospital. We had some best guesses, but we simply could not know for sure. Most excruciatingly, we were always wondering if we had succeeded in preventing a transmission.

At the peak of the crisis in 2020, we had almost 100 staff, from the original four. Our volunteer contact tracers were colleagues who were willing to be activated up to three times in a day (and night). This team was given the flexibility to amend contact tracing procedures on the fly to adapt to the ever-changing situation on the ground.

### INDUMATHI VENKATACHALAM

Consultant,  
Department of Infectious Diseases and  
Consultant,  
Department of Infection Prevention and Epidemiology

<sup>3</sup> For more details about the ARI wards, see Chapter 3.

<sup>4</sup> There was no evidence of intra-hospital transmission when a few staff from different areas were infected in 2020.

### MASSIVE CONTACT TRACING EFFORTS

In peacetime, contact tracing of intra-hospital exposure meant scanning the computer for wards through which the infectious patient had moved. But contact tracing in a patient who came from the community meant activity mapping, that is, mapping out, as comprehensively as possible, where he/she had been in the previous two weeks.

This information had to be submitted to the Ministry of Health (MOH) within two hours of knowing that someone tested positive. Our Molecular Pathology Laboratory (MPL) ran the COVID-19 polymerase chain reaction (PCR) tests three times a day, hence the last batch of results always came out after 10:00pm. As the number of positive results rose by the day, the number of times work started after 10:00pm went up.

When MOH introduced the “Swab and Send Home” scheme, there was also a need to contact patients whose swabs tested positive, and a need to inform those who were negative, for their peace of mind.

All the data had to be plotted on charts and graphs for the next day’s Command Centre meeting. The tiny but valiant Epi team needed help.

To ensure this critical piece of work – contact tracing – was carried out, the hospital poured manpower into Indu’s team. There was no shortage of volunteers. To obviate the need to train new people daily, Indu worked hard to assemble a team of regulars.

Dennis Yeo<sup>5</sup> was excited to be involved. “Here I was, a backroom boy, now having contact with COVID-19 patients and speaking to them through the phone. It felt surreal. It often took three or more hours to gather all the information required by MOH. Meeting the two-hour deadline was tough. It was exciting but draining. We developed a roster and took turns to do this round-the-clock every day. On a macro level, we created various daily reports that charted the evolving epidemic in SGH and Singapore. We were kept abreast of the latest developments in Singapore and abroad – it made us feel really special to be privy to such information.”

<sup>5</sup> Dennis Yeo, Executive, Department of Clinical Quality and Performance Management.

Other colleagues had a more pleasant task – to inform patients with negative results of the good news. Ulina Santoso<sup>6</sup>, Elisabeth Angelina<sup>7</sup>, Niny Purnama Sari<sup>8</sup> and Chin De Zhi<sup>9</sup> recollected. “It was not always easy. More often than not, the person on the other side spoke a different language. However, we knew our job was important. The simple phone call reduced their anxiety. The team ensured that every patient received the good news, even if it was through mail. Fortunately, our efforts were rewarded with, ‘I was very worried. This is the best news I have ever received!’”



With help from the Facilities team, a seminar room was converted in double-quick time in February 2020 into an Epidemiology outpost for contact tracing purposes.

### The infection prevention experts

It was not necessary for senior management to enunciate that preventing patient-to-staff transmission of the virus was of the highest priority. Everyone just knew it. The IPE team became a living resource library for all who wanted to know how to keep their staff and premises safe.

<sup>6</sup> Ulina Santoso, Senior Manager, Department of Clinical Quality and Performance Management.

<sup>7</sup> Elisabeth Angelina, Assistant Manager, Department of Clinical Quality and Performance Management.

<sup>8</sup> Niny Purnama Sari, Senior Executive, Department of Clinical Quality and Performance Management.

<sup>9</sup> Chin De Zhi, Executive, Department of Clinical Quality and Performance Management.

Refresher training in infection control and mask fitting were the first order of the day. The team took the staff through the steps of putting on and taking off Personal Protective Equipment (PPE) so that they would observe the sequence of first-in-last-out to prevent contamination.

Infection Prevention Nurse (IPN) Bushra binte Shaik Ismail<sup>10</sup> recounted. “At first, we did nothing but N95 mask fitting for three weeks for about 250 staff every day from 9:00am to 5:00pm. The stream of staff was never-ending. The fitting could not be rushed, as everyone needed to have the correct mask in order to stay safe.”

It was an unsettling time for all. Overwhelmed by fear and stress, some staff criticised their IPE colleagues for being “so slow”, causing one of her colleagues to break down and cry, recounted Bushra.

It was a time when fear and anxiety were pervasive. During one mask-fitting session, some staff reprimanded us for being unreasonable in enforcing strict mask fit requirements. This lashing was the last straw that triggered our tears, built up over the long period of stress.

Sheena Ong, Executive, Infection Prevention and Epidemiology

<sup>10</sup> Bushra binte Shaik Ismail, Asst Nurse Clinician, Infection Prevention and Epidemiology.

### Keeping everyone safe, everywhere

Everyone was unsure if their processes were safe. Step by step, the IPNs calmly walked everyone through, applying best practices and standard principles in infection prevention. Working with an existing network of staff appointed as Infection Prevention Liaison Officers in every department, the IPE team gave updates, clarifications and just-in-time teaching.

As the pandemic response moved beyond the hospital, our IPNs found themselves figuring out how best to keep everyone safe in unfamiliar locations<sup>11</sup> such as migrant worker dormitories and community care facilities. For every new offsite deployment, the IPN team was there to guide and to check. They also extended their expertise to the non-healthcare partners who ran these facilities, training their housekeepers, security officers and other staff.



N95 mask fit tests determine the mask brand and size that give the tightest seal for protection of the wearer.

<sup>11</sup> For more details about the offsite deployment, see Chapters 8 and 9.

## Cleaning every nook and cranny

Housekeepers risk exposure to pathogens when cleaning up and handling medical waste. Charity Naw Su Myat Phyu worked in the Isolation Ward (IW), cleaning the rooms of COVID-19 patients. She was grateful for the many training sessions she had attended. “At first, I was afraid. Then I thought, ‘I can do it because I have already been working in the IW for two years, so I know how to do hand hygiene and wear PPE to protect myself’. Before this, we were training for Ebola. Compared with Ebola, I did not think that COVID-19 was as frightening.”

The work was tiring. It took two hours to clean<sup>12</sup> a room after a patient had been discharged, and 40 minutes if the room was occupied. Equally challenging was the instruction to avoid talking to the patient to minimise the risk of infection. “We were told not to talk to the patient in the room. But it was so unnatural and unkind to ignore them.”

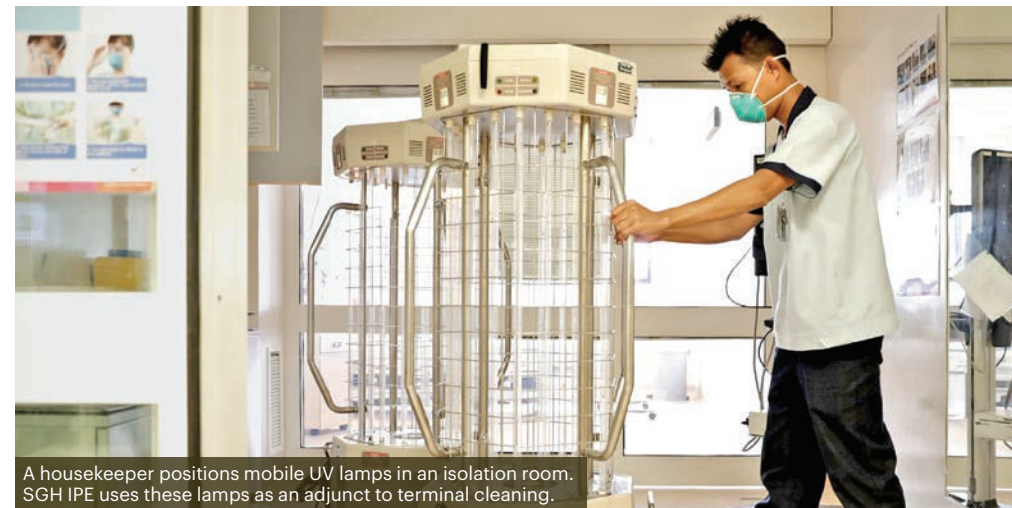
Each day after she entered the IW, Charity was not allowed to leave the premises until the end of her shift. Where she once went to the rest area in the hospital to meet her fellow housekeepers, now she could only connect with them over the phone or video calls. Her routine was just home-to-work, and then a shower, before heading home again.

<sup>12</sup> Only specially trained housekeepers are allowed to carry out terminal cleaning and disinfection. They follow a strict procedure, governing the type of cleaning agents and the sequence of surfaces to be cleaned.

## Cut off from home

Many housekeepers are Malaysians who cross the border daily to Singapore to work. They found themselves stranded when the Malaysian government introduced a Movement Control Order (MCO) on 18 March 2020. Housekeeper Muhammad Nurasyraf bin Rosdi, who worked in the ED, remembered the day he heard the news. “I had just finished my shift at 7:00am when my manager informed us that the border would close at midnight. She assured us, ‘Don’t worry, we are arranging accommodation for you.’ Thinking it was going to last just two weeks, I went home to pack my belongings. Little did I know that it was going to be extended again and again. It was almost a year before I finally went home, in January 2021, to help my wife and two-year-old daughter to move from Johor Bahru to Selangor, where they could be with my wife’s parents.”

His colleague, Khalyani Dilly Kannan, similarly found herself cut off from her husband and two-year-old daughter who lived in Johor Bahru. “I used to think that the daily commute was tiring. But I’d gladly do it now.”



A housekeeper positions mobile UV lamps in an isolation room. SGH IPE uses these lamps as an adjunct to terminal cleaning.

## Space converters

The ED bore the brunt of the initial surge, and resources were rushed to reinforce that front. Relief came quickly, recounted the head of department Kenneth Tan<sup>13</sup>. “Two days after we confirmed the first case, the situation was very bad – patients were overflowing to the ambulance porch. CEO<sup>14</sup> turned up with COO Jack<sup>15</sup>, and I was given very strong support. Whatever we needed at each point in time, we were given. I told Jack my people needed lockers ‘maybe by tomorrow’. He said, ‘My people are coming now’.”

At the ED, it was important to separate patients with fever from other patients to minimise the risk of transmission. The 11-patient fever zone<sup>16</sup> was rapidly overwhelmed. There was an urgent need to have an additional fever area.



Cubicles were quickly added at the Ambulatory Surgery Centre (ASC), an area adjacent to the Emergency Department. This portion of the ASC became the ED's second fever area.

<sup>13</sup> Dr Kenneth Tan, Head and Senior Consultant, Department of Emergency Medicine.

<sup>14</sup> Dr Kenneth Kwek, Chief Executive Officer.

<sup>15</sup> Tan Jack Thian, Chief Operating Officer.

<sup>16</sup> For more details on the fever zone in the ED, see Chapter 1.

Within hours of activation on 24 January 2020, the Facilities Management & Engineering (FME) team created cubicles at the adjacent Ambulatory Surgery Centre (ASC) to serve as holding area for people with suspicious symptoms. By converting spaces such as those at a nearby bridge and at a multi-storey carpark<sup>17</sup>, FME added 120 beds to the Fever Screening Areas (FSA).

## Evolving workspaces

As the number of cases rose, the hospital knew that the crowd at the ED would only get bigger. Converting the multi-storey carpark into an FSA was one of the contingency plans in the playbook, and had been exercised before.

On 20 March 2020, the FSA at the carpark received its first patients – those who required swabs to rule out COVID-19. At the peak, the number would hit 100 a day. This screening area was later equipped to accommodate patients who had to stay overnight to await their swab results.

Emergency physician Fua Tzay-Ping<sup>18</sup>, who oversaw the FSA, remarked. “I was impressed that the Preparedness and Response Department (PRD) and the rest of our Operations Division managed to retrofit an existing carpark into a functional clinical space. The demarcation of clean and dirty clinical areas was well thought through, like the central clean staircase for staff to move between decks without encountering patients, the staff pantry and gender-specific toilets with staff showering facilities. We even had an on-site X-Ray service.

<sup>17</sup> For more details about the planning and preparation to equip the carpark as an FSA, see Chapter 2.

<sup>18</sup> Dr Fua Tzay-Ping, Consultant, Department of Emergency Medicine.

We are grateful that doctors from Radiology and Pathology – departments that usually do not treat patients – stepped forward to volunteer in the FSA. Nursing manpower came from the Operating Theatres, Community Nursing as well as the Singapore National Eye Centre (SNEC)<sup>19</sup>.”

## Wireless but connected

IT specialist Benedict Tan<sup>20</sup> worked closely with the hospital’s IT partners and vendors. With news of the first case, he placed these partners on standby. Even then, he was surprised by their quick response. “When I got the call that the ED needed network points at the interim fever area at the ASC, I activated the SGH IT team. Expecting them to take some time, I decided to have my dinner first. When I turned up at SGH, I asked the Security staff, ‘Anyone here to do cabling?’ ‘They’ve gone home. The job has been done.’”

The IT partners kept pace and went on to enable many needs in unusually quick time, both in the hospital as well as in the external operations.



The IT team also helped to cable up the Fever Screening Area at the multi-storey carpark.

<sup>19</sup> The SNEC is located on SGH Campus. Both SNEC and SGH are part of the SingHealth cluster.

<sup>20</sup> Benedict Tan, Group Chief Digital Strategy Officer and Chief Data Officer, SingHealth. He was previously head of IT in SGH.



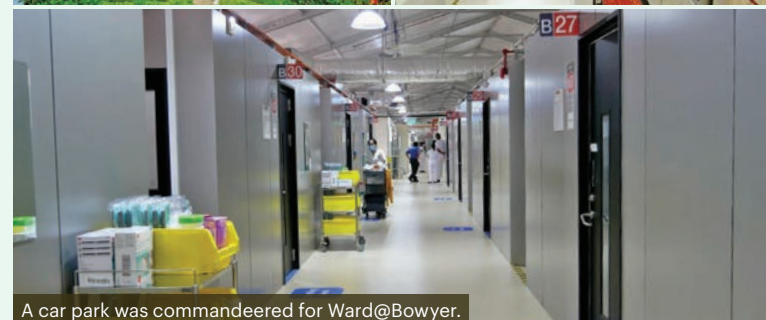
## 50 BEDS IN 50 DAYS

### How SGH turned a carpark into a COVID-19 ward

At the peak of the outbreak in April and May 2020, SGH saw 200 to 300 suspected and confirmed COVID-19 cases at any one time. The hospital converted normal wards to house isolation patients but it was necessary to plan for more. In mid-May 2020, SGH started to build, in a carpark, an IW with 50 rooms, every one of them negatively pressured. Ward@Bowyer admitted its first patients on 15 July 2020.

Ward@Bowyer was set up in the middle of the Circuit Breaker, a partial national lockdown. There was supply disruption of materials and manpower, as migrant workers were not able to leave their dormitories.

“Our service partners were experienced and resourceful, and together with help from colleagues across SGH, we were able to complete the ward in a mere 50 days,” said project manager Raphael Heng<sup>21</sup>.



A car park was commandeered for Ward@Bowyer.

<sup>21</sup> Raphael Heng, Director, Department of Facilities Development, SingHealth.



## Raising the drawbridge

To protect patients and staff, visitors with travel history or flu-like symptoms were not allowed into the hospital. When patients who met these criteria turned up for their appointments, they were managed with the strictest of protocols, safely away from others. The hospital also restricted visits to the wards, first cutting the numbers and then later allowing only those designated by the patients<sup>22</sup>.

Sandra Aw<sup>23</sup> had just taken charge of Visitor Services when the pandemic hit. She was acutely aware of the heavy responsibility of being gatekeepers. “Getting the public’s cooperation was an uphill task, as most people did not yet understand the reasons for the many restrictions. Visitors were upset and emotions ran high. Some resorted to making false declarations to gain entry. It was very stressful for the team – they were always worrying that they had let someone in who would ignite an outbreak in the wards.”

Many staff, especially administrators, volunteered at these screening stations, working outside office hours or on weekends. Initially, visitors had to complete paper forms, but soon, with the help of the IT team, SGH developed an online screening form that could be accessed via mobile phones. It was eventually used by many other healthcare institutions in Singapore.

When it became clear that perimeter screening<sup>24</sup> was here to stay, it was not tenable to depend on volunteers. The team from Specialist Outpatient Clinic (SOC) Operations took over the centralised effort, working with the Human Resources Division to roster staff from all over the hospital.

<sup>22</sup> SGH is a 1,700-bed hospital which had about 81,000 admissions a year. Before the pandemic, it saw 2,900 patients at its clinics and 340 patients at the ED every day.

<sup>23</sup> Sandra Aw, Assistant Manager, Visitor Services.

<sup>24</sup> Perimeter screening, a concept first deployed in SARS in 2003, was a critical plank of the hospital’s efforts against the virus. But it was labour-intensive, even with the app. Nevertheless, it gave staff another avenue to join in the COVID-19 fight. In a survey conducted by the hospital’s Health Services Research Unit, many of the staff described their shifts at the perimeters in the form of a service, not just to the hospital but also to the nation, and expressed satisfaction with the opportunity to be a part of the hospital’s endeavours against the virus.



A man with travel history wanted to be with his wife, who was in labour. The guidelines then did not cover this specific situation. As a father, I knew I wouldn’t want to miss such an important moment. Together with our PRD colleagues, we engaged our ID doctors and IPNs. In the end, we managed to make special arrangements for him.

Yang Hui, Assistant Manager, SOC Operations

Initial MOH advisories also did not provide for those in quarantine or serving Stay-Home-Notices (SHN) to visit their loved ones, even those who were critically ill. SHN was mandatorily applied on anyone who had just arrived in the country. People who had travelled specially to see a loved one who had turned seriously ill found themselves trapped in a hotel instead. Seeking to balance public health and compassion, SGH put in place processes to allow the dangerously ill to receive visitors who were serving such a notice.

## Securing the supply lifeline

Whoever has the supply chain wins the war. That was the sentiment when the global scale of the pandemic became apparent, and countries started imposing export controls on essential items.

As part of disaster planning, SGH had always kept a seven-day stockpile of PPE, based on the highest single-day usage during the SARS and H1N1 outbreaks. Supply chain specialist Rosli bin Boedjang<sup>25</sup> explained. “It is part of our routine operations to prepare for various kinds of emergencies. For disasters such as mass casualty incidents, we have kits pre-packed and ready to go. During COVID-19, we acted to plan – auto-pushed PPE to the general wards and increased the stock levels for the isolation wards. We then tapped on the national stockpile at MOH for new supplies. At no point did we run out of essential items although we advised users to request smaller quantities each time. Meanwhile, we looked for new suppliers to diversify our sources. For example, when the supply of face shields began to fall short, we found a local manufacturer to make them in Singapore.”

Despite being well prepared, the team did find itself missing a key item in its store. Rosli continued. “Bottled drinking water was never in our inventory, but staff in PPE have to be kept hydrated to prevent heat injury. We got the request on a Sunday, when we could not reach any supplier. One of our men drove to a few supermarkets and hauled back cartons of water. The next day, we quickly firmed up contracts for regular supplies.”

When the hospital moved out to operate mobile teams in dormitories and isolation facilities such as hotels, the supply chain team also took care of the supplies the teams needed.

<sup>25</sup> Rosli bin Boedjang, Senior Manager, Supply Chain, ALPS-SGH Non-Pharma Logistics.

## Communicate, communicate and communicate

Jennifer Wee, Chief Communications Officer (CCO) described her team's role in epidemics. “Communicate, communicate and communicate. This must be the guiding principle. We knew from the start that in an outbreak, and a potentially prolonged one, communications would be key. We need to let our staff (and their loved ones) know that we will take care of them, and we need to help staff and patients make sense of an uncertain and confusing world. We need to engage them and increase their understanding of what needs to be done and why. That’s the best form of reassurance we can give to our colleagues at the frontlines. The Comms team has to be the wingman, standing alongside the leadership and ground staff, anticipating and reacting as appropriate.”

It was clear from day one that the hospital’s 10,000 staff had to stay connected, know what was happening, and advance with one mind and one purpose. As the nation’s flagship hospital with more than a million patient visits each year, SGH also had to ensure that patients and their loved ones were swiftly kept abreast of changes that impacted them.



Online platforms and video messages were among channels used by the leadership to answer staff queries in the initial days of uncertainty.

## Timely engagement

The Communications team has long been a member of the hospital's Disease Outbreak Taskforce (DOTF) and the inclusion of the CCO in the Command Centre, when it was formed in January 2020, was instinctive. Being involved in the daily leadership huddles, the team saw and heard, at source, how the situation evolved. The CCO and her team never needed prompting to come up with the right message at the right time. Kenneth Tan<sup>26</sup> appreciated their support when the ED was facing the heat. "Patients were evading our screening stations and we needed help with notices to discourage such behaviour. The Comms team and Facilities colleagues moved so fast that before I knew it, digital notices on TV screens were up. The team also helped to constantly update various advisory pamphlets given out to patients."

COO Jack had praise for the Communications team too. "Throughout the pandemic, rules for visitors to the inpatient wards were constantly changing. Communication materials were essential and had to be constantly updated on our website and in the hospital for immediate management of patients and visitors. The Comms team never failed to deliver."

## Daily assurances to build trust

One thing from SARS which the Communications team continued with was the daily note from the hospital's leaders. These memos kept the staff updated, and shared the leaders' perspectives of the evolving situation<sup>27</sup>. Named the CEO-CMB<sup>28</sup> Daily Note, it was another important tool for daily communications. Over a period of 200 days, the Note was emailed to staff every day. Thereafter, it was done on a weekly basis.

Communications specialist Claudia Yeo<sup>29</sup> was the key scribe who worked with the leadership to shape the messages. She analysed the challenges she faced. "What do we say, and how do we say it? How do we share news factually yet be reassuring amidst all the uncertainty?"

When very little was understood about the virus – how it spread, how quickly it would spread, how deadly it was, what precautions needed to be taken, and what the appropriate responses should be – the Note provided information frankly and was transparent about the hospital's perspective.

As the number of cases climbed, some vital questions emerged among the staff. Would resources be adequate to keep us safe? If the outbreak became widespread, would the hospital be overwhelmed by the infected? The Notes helped to sustain trust and confidence in the hospital's leaders and their decisions.

### COMMUNICATION MATERIALS



Large digital displays of the latest visitor policies at the entrances to SGH.

<sup>26</sup> Dr Kenneth Tan, Head and Senior Consultant, Department of Emergency Medicine.

<sup>27</sup> During SARS in 2003, the notes were printed on coloured paper and sent out to individual departments, for dissemination to all staff. In 2020 they were, naturally, emailed to staff.

<sup>28</sup> The Chairman of Medical Board (CMB) oversees and guides the care that is provided by the clinicians in the hospital.

<sup>29</sup> Claudia Yeo, Senior Manager, Communications Department.

For medical social worker (MSW) Olivia Khoo<sup>30</sup>, the Notes were a guiding light in her role as a leader. “The CEO-CMB Daily Note has been instrumental in helping us pitch our operations and day-to-day work. These materials are responsive to the larger environment and they serve as great guidance for us managers. The memos unify the leadership at all levels. With such materials, we are not alone in this leadership journey.”

In 2020, the Communications team crystallised a key concept honed from the Hepatitis C outbreak<sup>31</sup> in 2015 – never let our staff read a piece of breaking news about the hospital from the media. Ensuring that they get first-hand news from the hospital leadership fostered trust between the leadership and our staff.

This was clearly articulated from the very first memo from the CEO to the entire SingHealth cluster, announcing the first case in SGH and Singapore – “The press conference by MOH is currently ongoing but we wanted to let you know first”.

To adhere to this principle, the Communications team negotiated with MOH, which agreed to the hospital releasing its statements minutes before the news embargo ended. Communications expert Angela Ng<sup>32</sup> revealed. “This is a relationship nurtured and built over years. It underscored the confidence that MOH had in us to not break any media embargo.”

<sup>30</sup>Olivia Khoo, Head, Department of Medical Social Services.

<sup>31</sup>The Hepatitis C outbreak in 2015 affected 25 patients in the renal wards and was linked to eight deaths. Twenty of the patients were kidney transplant recipients, see Chapter 2.

<sup>32</sup>Angela Ng, Head and Director, Communications Department.



## Connect often, consistently and honestly

Frequent webinars, townhalls and other meetings were held to allow senior management and domain experts to explain key issues and take questions from staff. Hospital leaders also did regular walkabouts around the hospital, to meet and address staff concerns and needs first-hand.

At a webinar with staff, CEO Kenneth commented. “Sometimes, people look at Communications as a bit of propaganda. In reality, the team works closely with senior management so that when a decision is made, the right message is communicated.”

## Sunshine amid the gloom

The Communications team also understood the importance of helping the public understand the situation on the frontlines. If staff at work could be portrayed sensitively, it would go a long way towards building pride among the staff.

When nurses were ostracised by the public fearing contagion, the hospital took to social media to call for support and respect.

The team was more than happy to facilitate when a request was received from the media. Angela recounted, “A photo-journalist wanted to be allowed in, to take photos for a local newspaper<sup>33</sup>. Most of the media coverage on COVID-19 then consisted of interviews, with very few images of the frontline in the hospitals. We felt that this photo story had to be told. We were able to assure management that we knew what to do, to make sure it would be safe, and that the images would tell the right story.”

Media specialist Carol Ang<sup>34</sup> added. “The media was asking to interview doctors and nurses. We were intentional in offering colleagues in less known but critical roles as well. Our contact tracing colleague, Edwin Conceicao<sup>35</sup>, became a bit of a celebrity. His interview<sup>36</sup> was reproduced on many media outlets overseas, owing to his personality and his unusual role.”



The Straits Times ran a photo feature on 16 March 2020 which gave the public a rare glimpse into happenings in the hospital. The Communications team made special arrangements to enable the project by the photo journalist.

<sup>33</sup>For the results of these efforts, see <https://www.straitstimes.com/singapore/health/clean-hands-open-hearts>.

<sup>34</sup>Carol Ang, Senior Manager, Communications Department.

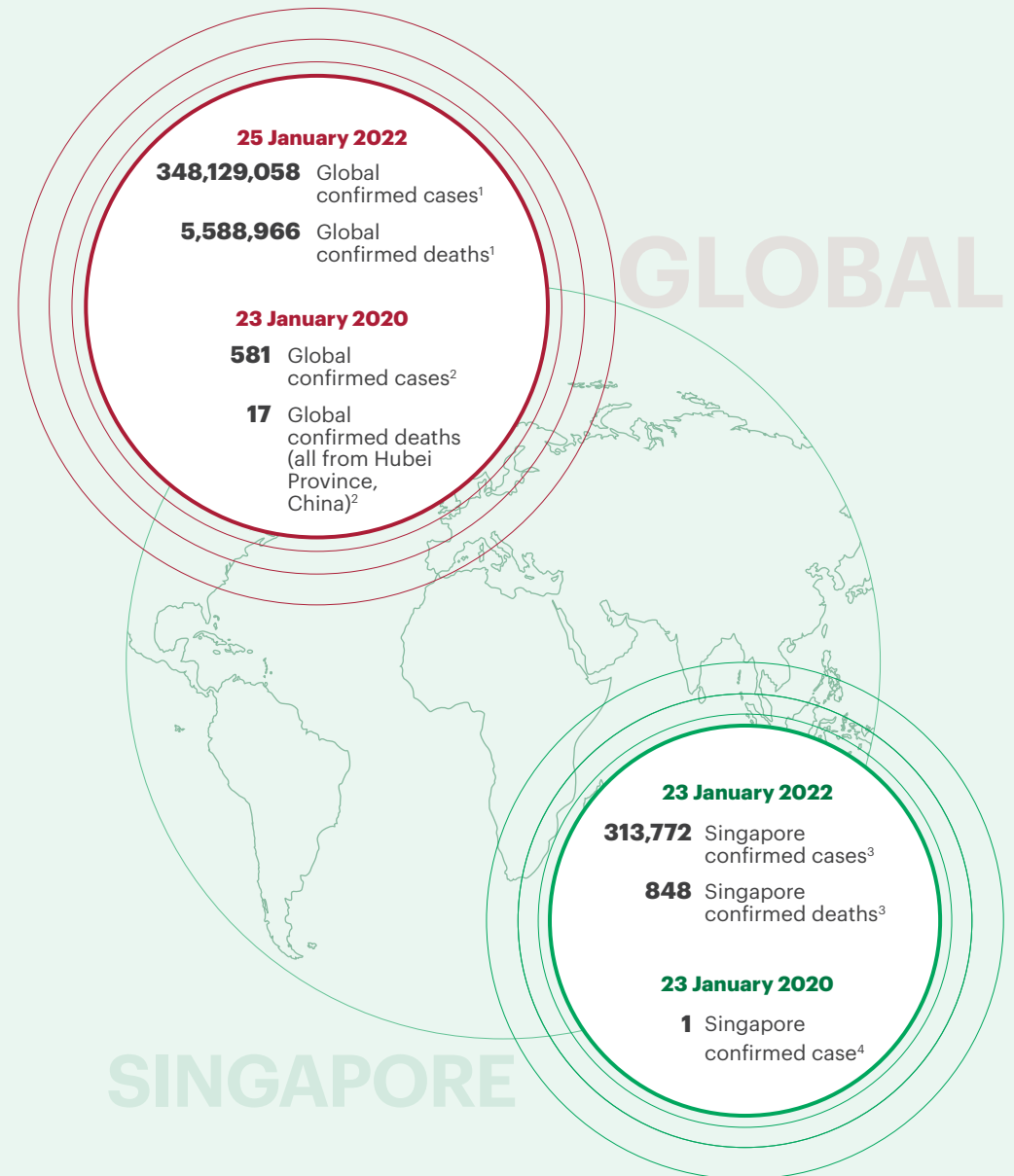
<sup>35</sup>Edwin Philip Conceicao, Senior Executive, Department of Infection Prevention and Epidemiology.

<sup>36</sup>Reuters. 'Drop everything, scramble': Singapore's contact trackers fight coronavirus. 13 March 2020 [Internet]. Available at: <https://www.reuters.com/article/us-health-coronavirus-singapore-tracing-idUSKBN2101A7>.

CHAPTER 5

# Fighting For Every Breath

COVID-19 CASES AT A GLANCE



<sup>1</sup> World Health Organisation weekly operational update on COVID-19 on 25 January 2022.  
<sup>2</sup> World Health Organisation Novel Coronavirus (2019-nCoV) Situation Report on 23 January 2020.  
<sup>3</sup> The Straits Times.  
<sup>4</sup> Ministry of Health, Singapore.

The ringing phone interrupted the silence of the night. I was the chest therapist covering ward 68. The medical officer (MO) on duty was going to transfer another deteriorating case of the new infection to the Intensive Care Unit (ICU). When I arrived, the patient was huffing and puffing away, supported via a facemask blowing 50% oxygen.

The experience from overseas had identified elderly persons with comorbidities as a group that fared worst. Like a few others already in our ICU, this one was elderly, but not frail or debilitated. They were community-ambulant, independent individuals who had reasonably well-controlled conditions like diabetes or hypertension. They were in many ways good for their age and often enjoying their role as grandparents. These were not patients whom we would routinely expect to fall critically ill and we were not willing to give up on them. Not without a fight anyway.

The patient was clearly running into deep trouble – the pulse oximeter's oxygen reading was falling precipitously. The young doctor was giving a slew of instructions on what to prepare and whom to activate.

Infection prevention rules were as strict in the ICU as anywhere else. In those uncertain times, anyone going into an isolation ICU room had to wear a Powered Air-Purifying Respirator (PAPR)<sup>5</sup>. This was on top of all the regular personal protective equipment (PPE) including cap, goggles, N95 mask, gown and gloves. Entering and leaving the room was minimised, not least because of the laborious process of donning and doffing the protective gear. Such minimisation of movement meant that all the necessary equipment had to be anticipated and prepared in advance. ICU procedures required long lists of equipment and even longer lists for contingencies. As there was limited opportunity to step out of the room if something had been missed out, a whole pile of equipment was assembled. Specifically, two trolleys were prepared: one for intubation of the patient's windpipe and the other in case there were difficulties getting the tube in.

Anticipating contingencies also extended to alerting the necessary personnel. The anaesthesia airway team had to be informed in advance that a positive case was to be intubated. They obliged by turning up and were already waiting right outside the patient's room. To perform the

<sup>5</sup> A Powered Air-Purifying Respirator (PAPR) is a hooded device that forces air through purifiers before allowing it into the hood, supplying the wearer with purified air.

procedure, the intensivist<sup>6</sup>, medical officer, ICU nurse and I all entered in protective gear. Another nurse stood at the doorway of the anteroom to act as a runner, in case messages needed to be relayed or additional equipment was required. Multiple drugs were also stashed in the anteroom in anticipation of emergencies: drugs to sedate the patient, to reverse sedation, to support the blood pressure, to correct an abnormal cardiac rhythm.

It was impossible to hear yourself in the PAPR, let alone relay instructions. All communication was through hand signals or shouting. Before entering the room, we had a quick huddle, going through every step of the procedure. Hopefully things would run like clockwork. The patient was obviously terrified. He had only hours before being informed of the unwelcome diagnosis and now was struggling to breathe. Being able to communicate while decked from head to toe in PPE was not something I had learnt in training. And we were literally shouting above the sound of the PAPR. A combination of patience, exaggerated gestures and smiling with your eyes, perhaps. The family had already received the dreaded late-night call from the young doctor explaining the patient's deterioration and the need for life support. One could imagine the disorientation among the family members – being interrogated by Ministry officials, seeing one another go into quarantine, trying to make arrangements to survive a strict Stay at Home order, and now this.

Thankfully the intubation was smooth. With a video laryngoscope, we could confirm the passage of the tube through the vocal cords. Not that it was my first time seeing it, but this time, it was the very street where SARS-CoV-2 lived. Surreal? No, just real. We connected the tube directly to a ventilator. No manual bagging, a usual peacetime practice. We could not allow aerosol spread of the virus. I did not listen to the chest – had not heard anything with my stethoscope while wearing the PAPR. I squinted through the shield for the reassuring misting<sup>7</sup> of the tube – well, yes, maybe it was there.

## RESPIRATORY THERAPIST

COVID-19 ICU team

<sup>6</sup> Intensivists are doctors who provide sub-speciality care for critically ill patients, usually in the ICU.

<sup>7</sup> Condensation on the inner surface of the endotracheal tube is an indicator that the tube has been inserted correctly.

## Bracing for the surge

As cases began to emerge outside China, nurse Patricia Yong<sup>8</sup> knew that once a case appeared in Singapore, ICU beds would be needed, and in good numbers. Chest physician Phua Ghee Chee<sup>9</sup> remembered that modelling had predicted that the peak would occur in April 2020. Indeed, the Ministry of Health (MOH) had told them to prepare for a 400% surge.

To avoid infection prevention lapses in the high stakes environment of an isolation ICU, Patricia instinctively wanted a buddy system, even though this would mean more manpower. “ICU nurses have ego, built on the high standards required of their specialisation, so a buddy system is important. It is very crucial to have eyes looking at you when you enter the room.”

### THE INTENSIVE CARE UNIT (ICU)

The ICU is a critical facility for managing patients whose lungs are injured to the extent that they cannot perform their usual function of exchanging oxygen and carbon dioxide. Such patients need ventilator support, via a machine that delivers oxygen into their lungs. The severe form of the novel infection was, ultimately, a pneumonia. The first paper from Wuhan, published in *The Lancet* on 24 January 2020, indicated that 29% of 41 people who caught the virus ended up being unable to breathe on their own, requiring ICU care. Today, with the large worldwide experience, we know that a much smaller percentage end up in the ICU. The figure is even smaller for the vaccinated who suffer a breakthrough infection.

Upskilling for ICU nursing would require much more than a theoretical refresher. Along with nurse Irene Too<sup>10</sup>, Patricia created and ran a hands-on ICU course, training six nurses at a time.

<sup>8</sup> Patricia Yong, Deputy Director Nursing, oversees nursing in the ICUs and the Emergency Department.

<sup>9</sup> Dr Phua Ghee Chee, Head and Senior Consultant, Department of Respiratory and Critical Care Medicine. He is also co-chair of the SGH Campus ICU Committee.

<sup>10</sup> Dr Irene Too Ai Ling, Advance Practice Nurse, Speciality Nursing.



Respiratory physician Chai Hui Zhong (not in PPE) conducting refresher training for staff deployed to the isolation ICU.

If there were a surge of critically ill patients, ICU-trained doctors would also be in short supply. Ghee Chee planned to conscript manpower to the ICU – every doctor who had had some ICU training in the past was a potential recruit. Of course, they needed refresher training. A plan was soon hatched for them to work in an isolation ICU with a trained intensivist as a supervisor, should the need arise. If stockpiled mobile ventilators had to be mobilised, there would clearly be no familiarity with them. A series of voice-annotated PowerPoint presentations and video demonstrations was created for an online ICU refresher course by respiratory therapist Constance Teo<sup>11</sup>, chest physicians Sewa Duu Wen<sup>12</sup>, Ken Goh<sup>13</sup>, Chai Hui Zhong<sup>14</sup> and nurse Ng Lit Soo<sup>15</sup>. The videos were completed within two weeks with help from

<sup>11</sup> Constance Teo, Principal Respiratory Therapist, leads the team of Respiratory Therapists in SGH.

<sup>12</sup> Dr Sewa Duu Wen, Senior Consultant, Department of Respiratory and Critical Care Medicine. He is also Director of the Medical ICU.

<sup>13</sup> Dr Ken Goh, Consultant, Department of Respiratory and Critical Care Medicine.

<sup>14</sup> Dr Chai Hui Zhong, Consultant, Department of Respiratory and Critical Care Medicine.

<sup>15</sup> Ng Lit Soo, Advance Practice Nurse, Nurse Clinician, Specialty Nursing.



Jayakumar Selvam<sup>16</sup> of SingHealth Academy. Posted on the internet and social media, the videos received more than 30,000 views and

**AIRWAY MANAGEMENT  
IN THE CRITICALLY ILL  
PATIENT - YOUTUBE**



These videos became compulsory viewing for trainees in other hospitals too.

garnered an international following. Our national role in ICU pandemic training was sealed when these videos became compulsory viewing at several other hospitals in Singapore.

In addition, there were also concerns about the stocks of sedation drugs available. Ventilator management of the acute respiratory distress syndrome<sup>17</sup> would be impossible without them. Discussions were made about having substitutes in the event supplies ran low. A chest physician wondered. “Were we really going to use sublingual lorazepam and fentanyl patches if we ran short of intravenous morphine and fentanyl? Would we really prescribe rectal paracetamol suppositories when oral and intravenous formulations were depleted?”

There were no good answers. The operating theatres, which also used the same sedatives, worked hard to revise their processes, and switched to substitutes<sup>18</sup>. The ICU team ensured that every single item was procured for stockpile or a substitute identified. Even the amount of oxygen available to the hospital was checked.

<sup>16</sup> Jayakumar Selvam, Associate Executive, Academia Education Facilities Management, Office of SingHealth Academy.

<sup>17</sup> Acute respiratory distress syndrome (ARDS) is a form of lung injury that is associated with high mortality. Mechanical ventilation is key to treatment.

<sup>18</sup> For more details about the use of substitutes, see Chapter 7.



Care team prepares trolleys of equipment outside the anteroom as colleagues in PAPR get ready to enter an isolation room.

Surprisingly, it was the cheap and mundane items that were at risk of disappearing. Syringes and 50ml saline bottles were running out fast because of just-in-time supply algorithms. The team embarked on a conservation strategy. But first they had to work with the Infection Prevention and Epidemiology (IPE) team to consider which items could be kept for per patient use. One of the items they decided to conserve was the ventilator tubing. Working with the Infection Prevention Nurses (IPNs), they checked every manufacturer’s recommendations closely, and used every tubing to its limit, rather than change them every 48 hours, as was the norm.

Intensivist Anantham Devanand<sup>19</sup> recalled. “There were initial fears over shortages of masks and PPE. But those supplies were managed such that we never felt unprotected. We had been reassured that no one would be put in harm’s way and no one was.”

<sup>19</sup> Dr Anantham Devanand, Senior Consultant, Department of Respiratory and Critical Care Medicine.

## TEAMWORK BETWEEN INTENSIVISTS AND INFECTIOUS DISEASES (ID) PHYSICIANS

ID physicians have always been close allies of intensivists. This bond was further strengthened during the pandemic. One of the isolation rooms was converted into a huddle room, where we held daily case discussions with the ID team. Each patient was discussed at length. The ID doctors helped the ICU team with therapeutic strategies.

Initially when there was no known therapy, we repurposed existing drugs such as lopinavir-ritonavir, based on biological plausibility.

At that time, we had concerns about steroids because of the frequency of secondary infections, and the experience in SARS had been negative. Eventually, data came through and therapeutic options expanded: remdesivir, dexamethasone, convalescent plasma and tocilizumab.

Some patients' family members did internet searches and advocated innovative therapies supported by limited data. It was understandable that they felt the need to do something for a loved one who was dying. Acknowledging that sense of helplessness in the family and respectfully educating them on the value of a data-driven approach in the desperately ill was no easy task.

### ANANTHAM DEVANAND

Senior Consultant,  
Department of Respiratory and  
Critical Care Medicine

## Care through the final days

In the first year of the pandemic, Singapore had very few ICU deaths, an impressive statistic. The remarkably small number of deaths belies the work that fell on the ICU teams. The majority of the patients in the isolation ICU did not have confirmed COVID-19. They had critical illnesses, usually non-COVID pneumonia or some other condition causing respiratory failure. But obviously such patients would have cough or breathlessness or fever. SGH considered it imperative that COVID-19 be excluded in these patients before allowing them to be nursed in a non-isolation ICU. This meant that even patients who did not have COVID-19 were separated from family during the initial stages of critical illness.

Yet, one death is one too many. Palliative care physician Jamie Zhou<sup>20</sup> and medical social worker (MSW) Andy Sim<sup>21</sup> recollected how nurses, generally not used to grief and loss conversations, had to take over the role of the MSWs, who were not allowed to enter individual patient rooms



A doctor in PPE inside the anteroom shows the patient's ECG to fellow doctors outside.

<sup>20</sup>Dr Jamie Zhou, Consultant, Division of Supportive and Palliative Care, National Cancer Centre Singapore.

<sup>21</sup>Andy Sim, Principal Medical Social Worker, Department of Medical Social Services.

in the isolation ICU. “MSWs are trained to provide grief counselling and are usually there when doctors inform relatives of a death, especially sudden deaths. In the isolation ICU, we are normally the ones to assist with the last call. During COVID-19, the task fell on the nurses. The MSWs felt handicapped and the nurses felt burdened, having to deal with the emotional part of grief and loss. It took a lot from them, and was quite traumatic for some.”

Although isolation patients were not allowed visitors, those on the dangerously ill list (DIL) were permitted a limited number. The visitors, however, had to stand outside the anteroom<sup>22</sup> of ICU patients.

## A last reunion

The team had to find innovative ways to work around the restrictions. They quickly drew up a protocol for virtual family conferences. As MSWs were not allowed to enter the patient’s room, they trained the nurses. They purchased a mobile phone, which nurses could bring into the ICU room (it had to be cleaned rigorously before it could be brought out).

The family conference usually allowed the ICU doctors to connect with the family, building trust and sometimes breaking bad news to them. Using the video call function, the nurse enabled the family to see the patient. Patients who were conscious would be able to see and hear their family members.

<sup>22</sup>A proper isolation room always has an adjoining anteroom. Here healthcare staff take off their PPE. The anteroom also allows for sophisticated air engineering, preventing air from reaching the rest of the ward beyond it.



## THE CALL OF DUTY

It was tough to listen in on their parting words. I was fully gowned up – there was no way for me to wipe my tears. I tried to distract myself with the tasks in the room. To hear but not to listen.

The patient was struggling to stay alive, the numbers on the monitors were blinking red, and the loved ones could only view through glass doors. There was a phrase, I thought – ah, “so near yet so far”. What should have been a final loving touch was reduced to an intercom encouragement, “stay strong, fight on”.

I was told to do three video calls for my patient, one with each of his children. I had to be in the room, listening to their conversations. As the nurse, I had to do it. The call of duty. Each conversation was supposed to last 15 minutes. I had to do it three times.

And then the ECG flatlined. What do you tell the children?

But somehow they knew.

The patient’s wife arrived at the ward to see him. A scene that burned into my heart. A pair of love birds separated by the anteroom. She pleaded to let her enter the room, to at least be inside the anteroom. We declined. I explained why, but those words – those were stabbing words.

It felt morally wrong to let an elder beg to see her love for the very last time, to exchange a final touch. But the stakes were too high. We had an obligation to the nation. It was for a greater good, but at the expense of their grief. Protecting our People took precedence over their grief. An obligation we had to uphold, whether it was morally right or not.

All I could do was apologise. The word “sorry” could never describe the guilt I felt and could never fill the void in their grieving hearts. With the MSW nodding his assent, I offered a final video call, to bridge this physical gap between the two doors. Maybe the family could have closure. The patient’s wife finally broke down and acknowledged his death, while I stood in the patient’s room, holding the phone as close to his face as possible. Guilt ate into me but it had to be done this way. Do no harm. Beneficence to our People. This was the call of duty.

### LEE SHU ZHEN

Senior Staff Nurse,  
Urology Centre

*She was one of those who took up the challenge of the crash course to serve in the isolation ICU. She had not bargained for the insights she would acquire.*

It was a tremendously difficult time for the family. The daughter went on social media, fought hard for novel therapies for her father. There was the fear of the unknown disease, fear of losing a loved one, and exasperation because they couldn't figure out how he contracted it. It was an emotional roller coaster ride as his condition waxed and waned. I remember standing with the family outside the door to the patient's room. When a nurse extended an arm to one of them, she turned and said, "Why are you touching me? Are you not afraid that I am dirty?"

Lee Guozhang, Consultant, Department of Internal Medicine

*He was part of the team providing palliative care for the first COVID-19 patient who passed away in SGH.*

Despite the gloom, every now and then, shafts of light shone through. MSW Andy recalled a special moment. "One day, we noticed that a patient who had been deteriorating actually had consecutive negative viral swabs, meaning he was no longer infectious. Now the family could be by his side in his last moments. After letting them into the room, I had this feeling that they wanted to take a final photo with their father. Taking photos and videos is not allowed in the ICU, but how could I deny them? So I said nothing and left the room.

But a few moments later, the son sought me out. I quickly consulted Sister Z<sup>23</sup> and the other nursing sisters on duty – they all had no problems with the request.

The son said, "Thank you for taking our last family photo."

### Hope in the midst of heartbreak

Not all cases ended in defeat. There were wins too. Lots of them. Some of the sickest patients eventually walked out of SGH. The journey for some of them was long-drawn, with a difficult ICU course followed by prolonged rehabilitation, but they made it. So many dedicated healthcare professionals working intensively for the patients – this must have played some part in the surprisingly low mortality of COVID-19 in Singapore, in 2020. Every success kept the team going.



Video calls to his family in Bangladesh supported Mr Islam Mujahidul (bottom right) through the critical stages of his illness in the ICU. MSW Andy Sim and colleague are seen on the left.

<sup>23</sup> Ziyadah binte Zainuddin, Senior Nurse Manager, Ward 68 (Isolation).

Islam Mujahidul<sup>24</sup>, a Bangladeshi worker, was admitted to SGH on 23 May 2020 for headache and respiratory symptoms. He was diagnosed with a brain bleed as well as COVID-19. Andy continued. “We worked very hard to connect with and support his family (wife, two young children, numerous siblings and in-laws) in Bangladesh through multiple video phone calls. His condition was grave and he needed brain surgery. We were preparing the family for the worst. Amazingly, he made a miraculous recovery and managed to leave the ICU. He was moved to the isolation general ward where he received targeted rehabilitation.”

## Take a deep breath

The pool of respiratory therapists (RT) is very small. Unlike the other professions, there are no RTs outside the ICU who can reinforce us. I have learnt to take the time spent waiting in the anteroom for the doors to close or open as a time to centre myself, unplug from any messages, calls or emails and focus on the patient in front of me. I am one of the privileged few who have engaged with COVID-19 patients and listened to their stories, their hopes and their fears.

Constance Teo, Principal Respiratory Therapist who heads the RT team in SGH

<sup>24</sup> Mr Islam Mujahidul gave consent to share his details and photograph. He has returned to Bangladesh. Medical social worker Andy Sim helped to link his family with a non-governmental organisation there for financial assistance.



## PASSING THE BATON

In the early days of the outbreak, the worry was how infectious these patients were to healthcare workers. We had been burnt by SARS and for the older clinicians who experienced SARS and lost colleagues, this was always on our minds. But COVID-19 is much tougher than SARS. SARS was quick, brutal and then it was over. The fear and adrenaline carried us through the crisis. We have never faced a prolonged and seemingly never-ending pandemic like COVID-19. The challenge this time includes how to overcome pandemic fatigue, how to protect the mental health and wellness of our staff, how to re-energise our people and organisation.

Having a generation of healthcare workers who are veterans of previous pandemics is critical. It is not just useful from a standpoint of knowing what needs to be done and what to expect. More important, it provided reassurance and confidence to the younger staff members who were experiencing this for the first time. Even when the COVID-19 pandemic eventually passes, we can continue passing down these experiences to the next generation, in preparation for the next pandemic.

As a leader, it wasn't easy sending young colleagues into hot zones such as isolation ward, isolation ICU and even sending our ECMO team to work with the ICU team at the National Centre for Infectious Diseases. There was always the worry that I was sending them into harm's way. But I was grateful and inspired by how positive they were. We were never short of volunteers for the isolation wards. It was heartening that the newer generation of clinicians were as dedicated, committed and courageous as their seniors were. I am really proud of the new generation of healthcare workers. The future shines bright.

### PHUA GHEE CHEE

Head and Senior Consultant,  
Department of Respiratory and  
Critical Care Medicine

*Ghee Chee himself is a SARS veteran.*

## *The good in an invisible war*

*There are no gunshots  
No shrapnel on the streets  
No bodies strewn in debris  
They said, “you could never be too prepared”*

*Could anyone prepare for an invisible war?  
Like dominos we tumble  
A first, a second, then hundred and five  
Hang on, is it a couple of thousand now?  
The evening news is a daily guessing game*

*One did not plan for this  
When he opened his restaurant chain last year  
Or the marriage plans they had saved up for  
Yet one rises to the occasion  
Because there is no other way  
Out of nowhere  
A little girl writes a card  
Her whole class follows suit*

*A struggling stallholder  
Drops off hundred packets of food at the hospital door  
Thousands of other nameless acts  
Kindness has a domino effect*

*This too shall pass  
And when the lion city roars itself to life again  
Pavements will be walked on  
A carnival of colours  
Compassion will tide us through*

### **SHUBASHRI JEYARATNAM**

Medical Officer

*She was doing her posting at the Plastic, Reconstructive and Aesthetic Surgery Department when the outbreak started. She was subsequently deployed to the Department of Emergency Medicine and then to the Community Isolation Facility @ Expo (see Chapter 9).*

## CHAPTER 6

# The Caring Frontier

I was afraid that I would spread the virus to my housemates. I stayed home for 14 days and isolated myself in my room, checking my temperature every two to three hours as I was very worried. I also received many calls from the management asking about my condition. I was so happy and relieved to be well and free from COVID-19.

### **ZHENG ZHENZHEN**

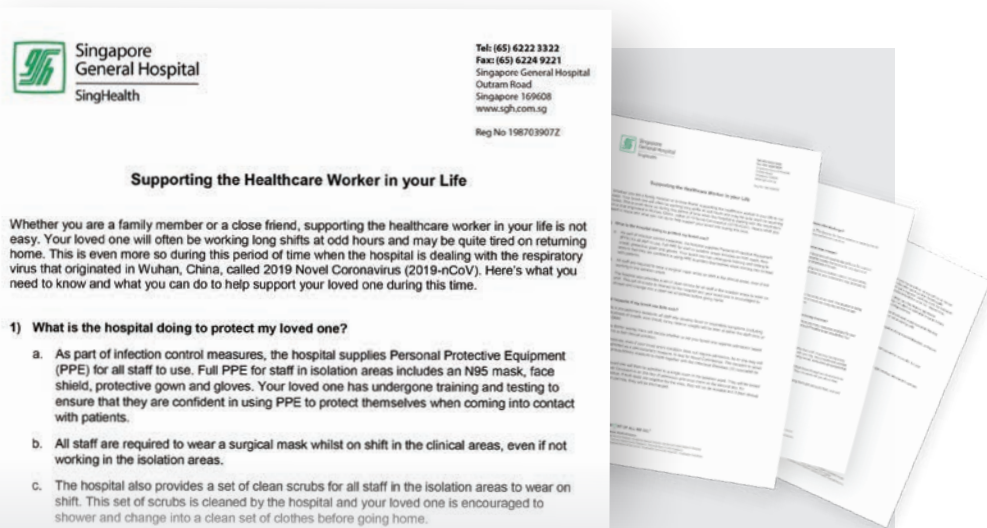
Senior Staff Nurse,  
Ward 68 (Isolation)

*In January 2020, she was exposed to SGH's second COVID-19 patient.*

## Care for the troops

SARS veterans understood that an epidemic would affect mental wellness. Psychologist Evelyn Boon<sup>1</sup> reflected on the impact. “Memories and challenges of those months during SARS came flooding back. It never struck me that I had been so traumatised.”

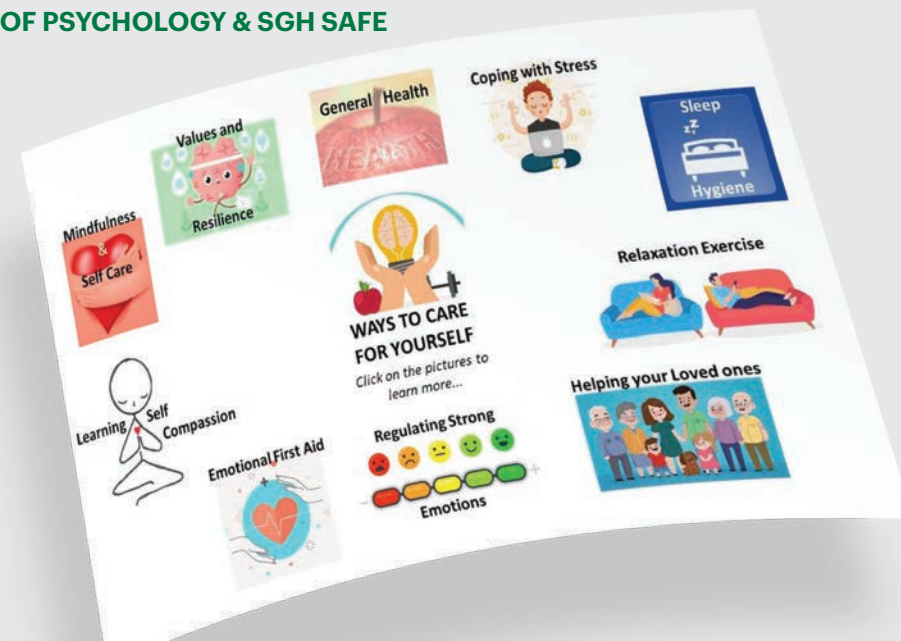
Evelyn remembered SARS as a chaotic period especially because the Department of Behavioural Medicine had just been formed. To help frontline staff cope, debriefing groups were initiated. In so doing, she learned how staff experienced varying levels of distress, and realised the importance of supporting them not only in their work but also in their personal lives. Therefore, when the COVID-19 pandemic began, Evelyn was ready for the challenges ahead. “Experience was indeed the best teacher. SARS and all the crises the hospital weathered gave me a mental playbook to work off from.”



The hospital prepared letters for family members of staff, giving them tips on how to support those in the frontlines.

<sup>1</sup> Dr Evelyn Boon, Head, Department of Psychology. She joined SGH in 1999. In 2003, when SARS struck, SGH had just set up the Department of Behavioural Medicine, which later became the Department of Psychiatry.

## RESOURCES FROM SGH DEPARTMENT OF PSYCHOLOGY & SGH SAFE



The slides from the Department of Psychology and the Peer Support Network were uploaded to the intranet for easy access by staff. This is the landing page of the repository.

She had a repository of slides already prepared for crisis use that only required some updating. The slides were made accessible through the daily Routine Instructions<sup>2</sup> and were uploaded on the intranet. Early in the outbreak, occupational health physician Gan Wee Hoe<sup>3</sup> also pushed for employees’ mental well-being to be taken seriously. Knowing that places like the Isolation Ward (IW) and the Emergency Department (ED) would be the most stressful places, Evelyn made efforts to speak to the relevant nursing managers to disseminate her team’s resources.

<sup>2</sup> Every day, the SGH Command Centre sends out Routine Instructions to all staff. These contain all the latest information and protocols on all matters relating to COVID-19, such as the latest COVID-19 wards, and the protocol to follow when a suspect case requires an operation.

<sup>3</sup> Dr Gan Wee Hoe, Head and Senior Consultant, Department of Occupational and Environmental Medicine. He went on to lead SingHealth’s Vaccination Operations Group when vaccines became available in January 2021.



## CEO as wellness champion

In March 2020, two members of our staff, both from the same department, were diagnosed with COVID-19<sup>4</sup>. At the Command Centre, there was much consternation. Was this patient-to-staff transmission? Had there been infection control breaches? The team from Infection Prevention and Epidemiology literally went into overdrive.

CEO Kenneth Kwek<sup>5</sup> recalled the harrowing moment.

I received a call at 10:00pm. We had a second staff in the same department who tested positive.

My heart fell. “How many others are there?” We started testing everyone – staff, patients ...

At that time, we had not established that they were infected in their social circles. I felt that I had let the hospital down. We knew from the start that we had to do all we could to prevent transmission within the hospital. I kept asking myself, “Have I dropped the ball in protecting my staff?”

<sup>4</sup> At that time, there were no reports of patient-to-staff transmission in any hospital in Singapore. In the subsequent months, there were a few more cases of infected staff but in all cases, contact tracing showed that they caught the infection in the course of their social or recreational pursuits. The infection did not spread beyond them – none of the staff contacts who were isolated and tested came down with the disease.

<sup>5</sup> Dr Kenneth Kwek, Chief Executive Officer.

Kenneth put aside his disappointment in his leadership, and took on the task of personally contacting the affected staff and their supervisors. He emphasised that it was not about how they had been infected, but how they were doing and if they needed support. He also sent an email to all staff in the affected department, assuring them of the hospital’s help. In the CEO-CMB Daily Note<sup>6</sup>, staff were encouraged to lend their support to the affected team members.

## Connecting with the hospitalised migrant workers

I remember how during SARS, Prof Ng Han Seong<sup>7</sup> had to come to the hospital one night because a patient who was nursed alone threatened to jump off the building. It dawned on me that isolation was good for other people but perilous for the individual<sup>8</sup>. When this epidemic began, I was worried about the impact of isolation on patients but I did not know what I could do about it. I am glad my colleagues actually knew what to do. Their efforts for the migrant workers who became our patients were quite touching.

Physician, Division of Medicine

<sup>6</sup> This is a memo from the CEO and the Chairman of Medical Board. It shares their perspective of the evolving situation with all staff. For more details, see Chapter 4.

<sup>7</sup> Prof Ng Han Seong, Emeritus Consultant, Department of Gastroenterology and Hepatology, was Chairman, Division of Medicine, during SARS.

<sup>8</sup> Some of the features of SGH’s isolation ward – ward 68 – arose from this incident. Every room has a window and a television set, see chapter 2.

In 2020, 54,505 out of Singapore's 58,320 COVID-19 cases were migrant workers living in dormitories<sup>9</sup>. The virus likely spread efficiently because of the communal living arrangements. At the peak of the outbreak in April 2020, more than 1,000 new cases a day were being detected in these dormitories.

Gastroenterologist Chow Wan Cheng<sup>10</sup> was concerned about the well-being of this special group of patients. She knew that for them, being in isolation in a hospital was an alien experience. She searched for ways to support hospitalised migrant workers. In response, Evelyn was swift to propose online support groups via the Zoom platform.

When migrant workers were admitted to the isolation wards<sup>11</sup>, they were given care packs that included information on weekly online support groups that were held in Bengali, Tamil, Burmese and Chinese. At the first support group session, Evelyn waited for the patients, but none came, even though many had indicated interest. It turned out that the explanations were not clear enough. After the information sheet was rectified, the virtual support group sessions took off. The response was tremendous, and Evelyn learnt a deep lesson. "Personally, this is the piece of work I am most proud of. The inpatient support group was also a humbling experience – it showed how privileged we all were. I had assumed that the app for the online meeting would be easy enough to navigate."

## iPad against isolation

In early February 2020, an IW patient gave feedback describing her difficulty obtaining information from the treatment team about her care, since healthcare workers were trying to minimise direct patient interactions to reduce infection risk. When Wan Cheng learned about this, she recalled how a colleague had described her SARS hospitalisation in 2003 as the sensation of being disconnected from the world, and more like being in a zoo with "curious spectators staring through the glass". She embarked on a project to mitigate the adverse impact of isolation on patients, a project that became the "iPad project".



Soft copies of books by local writers were uploaded into the iPad for patients in isolation. They were selected for their uplifting content and colourful designs.

<sup>9</sup> Source: Ministry of Manpower press release dated 14 December 2020.

<sup>10</sup> Dr Chow Wan Cheng, Senior Consultant, Department of Gastroenterology and Hepatology.

<sup>11</sup> By this time, isolation ward 68 was full. More and more wards were converted to house COVID-19 cases.

Wan Cheng brought together a team comprising nurse Ang Shin Yuh<sup>12</sup>, internist Natalie Woong<sup>13</sup>, research administrator Xin Xiaohui<sup>14</sup>, medical social worker (MSW) Crystal Chai-Lim<sup>15</sup>, medical administrator Lynn Tan<sup>16</sup>, Gastroenterologist Victoria Ekstrom<sup>17</sup>, communications specialist Tricia Ang<sup>18</sup> and Evelyn. They held their first meeting on 12 February 2020. Several months before, SGH had piloted a programme to study the pros and cons of a custom-designed app<sup>19</sup> on an iPad to improve communication between inpatients and staff. The team decided to re-purpose these iPads by uploading content that would be sources of support and information. Much of the supportive content was sourced from the recently established Medical Humanities Programme.

### THE MEDICAL HUMANITIES PROGRAMME

In August 2018, the Medical Humanities Programme was set up by the SingHealth Duke-NUS Medicine Academic Clinical Programme. There is increasing recognition of the value of the humanities (the “human sciences”) to clinical care. Art, prose and verse change the doctor’s perspective of their patient’s suffering. The arts also mitigate the depersonalisation arising from technological advancement and strict infection control. Using pantomime gestures to communicate while wearing personal protective equipment (PPE), or just letting patients know that someone was willing to listen – these were practical contributions of the humanities to patient care. Staff who share their experiences or their talents bond by seeing one another as people. Your colleague is more than the person who gets the job done.

<sup>12</sup> Ang Shin Yuh, Deputy Director Nursing. In 2019, she led a project to develop and use a mobile app for inpatients.

<sup>13</sup> Dr Natalie Woong, Consultant, Department of Internal Medicine.

<sup>14</sup> Xin Xiaohui, Senior Research Manager, Health Services Research Unit.

<sup>15</sup> Dr Crystal Chai-Lim, Master Medical Social Worker (Clinical), Department of Medical Social Services.

<sup>16</sup> Lynn Tan, Assistant Director, Division of Medicine.

<sup>17</sup> Dr Victoria Ekstrom, Consultant, Department of Gastroenterology and Hepatology. She is a member of the Medical Humanities programme.

<sup>18</sup> Tricia Ang, Senior Manager, Communications Department.

<sup>19</sup> “MyCare” app aimed to empower patients with better access to information about their care during their hospital stay. Patients could relay specific requests to nurses or queries to the doctors, view personal clinical information such as test results and access patient education and orientation materials.

The material uploaded to the bedside tablets included expert knowledge on COVID-19, updated government measures on the pandemic, interview videos with SARS survivors and medical humanities content. Wan Cheng felt that hearing the experiences of SARS survivors could offer patients hope, and give them a sense of solidarity from shared experience. Vascular surgeon Chng Siew Ping<sup>20</sup> and liver specialist Lee Kang Hoe<sup>21</sup> shared their SARS isolation and recovery experiences. Infectious Diseases (ID) physician Jenny Low<sup>22</sup> addressed COVID-19 facts and fallacies. There were also poems and stories, generously contributed by local authors, selected for their uplifting messages. The team decided to share their work on an academic platform and were pleasantly surprised when a leading international journal accepted their manuscript for publication<sup>23</sup>.

As more and more migrant workers were admitted to SGH, the iPad team saw that even more was needed to help this special patient cohort. The team needed to expand. Luckily, volunteers came forward to translate the materials into the native languages of the migrant workers. They even developed new material for this heterogeneous but burgeoning demographic, addressing concerns such as, “Who is paying for my hospital bill?”; “I need to continue sending money to my family – will I still get my salary?”; “How do I send money home?”, and “I have used up all the value in my pre-paid phone card — how can I call home?”

<sup>20</sup> Dr Chng Siew Ping, Senior Consultant, Department of Vascular Surgery.

<sup>21</sup> Dr Lee Kang Hoe is an intensivist in private practice, but he readily agreed to be filmed for the project.

<sup>22</sup> Dr Jenny Low, Senior Consultant, Department of Infectious Diseases. She is also active in COVID-19 research. For more details on research, see Chapter 7.

<sup>23</sup> Woong NL et al. Empower to connect and connect to empower: experience in using a humanistic approach to improve patients’ access to, and experience of, care in isolation wards during the COVID-19 outbreak in Singapore. *BMJ Open Quality* 2021;10:e000996.



## Big hearts for the little things

When Community Care Facilities (CCFs)<sup>24</sup> were set up, infected migrant workers found out that they were not going back to their dormitories when they were ready for discharge from hospital. This meant they did not even have a change of clothes nor any other personal items, since many had been whisked promptly to hospital when initially diagnosed.

Many nurses collected clothes from families and friends, and bought toiletries for these patients. As the number of patients rose exponentially, it became evident that a concerted effort was needed. Nurse Suriana<sup>25</sup> and MSW Vivian Chan<sup>26</sup> roped in Mumtaj Ibrahim<sup>27</sup> to tap on her network as SGH's manager for community relations. Despite having spent 20 years galvanising support for needy patients, Mumtaj was still amazed by the tremendous response that she received when she reached out for donations.



Assistant Director Nursing Ong Soon Lan (left) and nurse Suriana sorting out donated items for foreign workers. These packets of daily essentials were given to the patients before they were transferred to the Community Care Facilities.

<sup>24</sup> SGH also ran such isolation facilities in the community at the Government's behest. These were located within workers' dormitories, in hotels and in repurposed convention halls. For more details, see Chapters 8 and 9.

<sup>25</sup> Suriana binte Sanwasi, Senior Nurse Manager, Ward 58.

<sup>26</sup> Vivian Chan, Senior Medical Social Worker, Department of Medical Social Services.

<sup>27</sup> Mumtaj Ibrahim, Senior Manager, Community Relations, Communications Department.

## THE GOOD IN EVERYONE

Suriana first approached me for help to get prayer mats for Muslim migrant workers who were praying on the bare floor in the wards. I contacted a religious teacher and within three days, 100 mats were delivered, free of charge.

Then, I heard that these patients needed charging cables for their mobile phones. I put out a call on a chat group that had been started by the iPad project team. Very quickly, a random stranger called me, informing me that he had managed to collect a few cartons of assorted cables.

A pivotal point was when the Hindu Endowments Board contacted SGH, wanting to send food for our staff. Knowing that they had the resources, and a history of serving migrant workers, I seized the opportunity to tell them of the plight of these patients. The Board tapped on their network, which included merchants in Little India, familiar with the needs and habits of these workers. They put together care packs that included suitable new clothing, toiletries and other daily necessities. Taking the idea to the next level, the Board extended their generosity to all the public hospitals and eventually delivered about 5,000 gift packs islandwide.

I was able to link up with many donors and corporations and everyone was kind – they didn't hold back when I mentioned the migrant workers whom we were caring for at the Expo too. We gave out second-hand mobile phones, games, and even new sarongs and traditional treats like muruku for special occasions. Nobody placed restrictions on gifts based on either nationality or religion.

I was on the phone non-stop, fielding calls from strangers, corporations and high-level executives asking, "How can we help?" It is still very overwhelming for me, how everyone looked to me, taking on my suggestions. I really saw the good in everyone.

### MUMTAJ IBRAHIM

Senior Manager,  
Community Relations,  
Communications Department

## GOODWILL HAS RIPPLE EFFECTS

With work in the operating theatres grinding to a halt, I felt a pang of guilt and helplessness as we didn't have much clinical work while our colleagues in the ED, ID and various medical departments were stretched.

We soon got to know about the harsh conditions that our frontline colleagues were working in, such as having to wear their PPE in hot and stifling conditions. Stories of sweat pouring out of gloves, drenched scrubs, and facial abrasions from N95 masks were all too common. I imagined how uncomfortable, hungry and thirsty they must be, and the impact on their morale. Although I was not on the frontlines, I could surely support them from the sidelines, trying to be the wind in their sails.

My initial intention was to buy simple treats for ED staff to boost their morale as they toiled. Having worked in SGH's ED as a junior doctor during my training, I was aware that food was already routinely catered for the staff. My treats were intended to show them they were not alone and that we were all supporting and cheering them on. Morale can be the single greatest factor in success during war.

I made my first delivery of fried chicken on 31 January 2020 to the ED. I only realised the impact of my gesture when I received messages of gratitude from colleagues. News of this endeavour and others reached the ears of the senior members of my department and they donated a total of \$4,000 to continue to support these efforts. We spent it on food and drinks for colleagues in the fever area, IWs and Acute Respiratory Infection (ARI) wards, especially where some of our orthopaedic nurses were deployed<sup>28</sup>. The surgical, medical and anaesthesia teams that went on-call also enjoyed meals from our donors.

<sup>28</sup>The orthopaedic wards were among the first to be converted into ARI wards. For more details, see Chapter 3.



Mizan (left) collecting and showing off freshly-baked cookies.

We initially thought that COVID-19 was going to last several weeks. As the epidemic snowballed, there was an outpouring of gratitude from more Singaporeans to frontline workers. I asked some close friends if they wanted to donate money or food to the frontline teams. It was during this time that restrictions were placed on social gatherings and dining in.

A friend of mine (a Singaporean food writer<sup>29</sup>) offered to help extend these charitable endeavours to the Singapore community at large. We set up OurTreat, a non-profit initiative through a website<sup>30</sup>. Despite social distancing, we could still come together in spirit and share a meal to raise the morale of our frontline workers and support the battered F&B industry.

<sup>29</sup>The Edge Singapore. Food for thought. 15 June 2020. See <https://www.pressreader.com/singapore/the-edge-singapore/20200615/281981789849375>.

<sup>30</sup>Fatfuku. From MyTreat to OurTreat. 7 April 2020. See <https://fatfuku.com/ourtreat>.

We were happy to accommodate friends and family who donated by ordering directly at restaurants of their choice and worked with those restaurants to deliver the ordered food to the various departments in SGH. Through word of mouth and social media<sup>31</sup>, we collaborated with local celebrities<sup>32</sup> to increase our visibility to raise even more money for our frontline teams.

My friends and colleagues deployed to the dormitories across the island were working long hours in stifling conditions. Much of our time and effort was spent collating the number of meals and drinks, keying in orders on food delivery apps, then ensuring that the food and treats were delivered on time to various locations. We received a heavily discounted price for ice cream and sent cartons of them to the dormitories. We also sent them to the external operations base at Bowyer Block<sup>33</sup> in SGH, where the ice cream was dispensed to returning troops after a long day at the dorms. The happy faces and messages of thanks I received said it all. Yet I knew my work was not done.

While we started the initiative for frontline workers, we quickly realised that many units of our SGH family were knee-deep fighting this pandemic. We began channelling the donations towards the security teams, cleaning staff and perimeter screening<sup>34</sup> volunteers as well. We also sent a significant number of biryani bento boxes to colleagues in three polyclinics. Those fasting for Ramadan were able to take the meals home to enjoy in the evening after breaking their fasts.

As the donations continued to stream in, this outpouring of support was shared with other hospitals in Singapore. Through friends, we sent food and drink donations to Tan Tock Seng Hospital, the National Centre for Infectious Diseases, the National University Hospital, Ng Teng Fong General Hospital and Khoo Teck Puat Hospital.

**MOHD MIZAN MARICAN**

Consultant,  
Department of Orthopaedic Surgery

<sup>31</sup> Prestige Online. OurTreat, a new initiative, aims to support healthcare workers and F&B outlets. 8 April 2020. See <https://www.prestigeonline.com/sg/wine-dine/dining/ourtreat-support-healthcare-workers-and-fb-outlets>.

<sup>32</sup> 8 DAYS. Billionaire heiress Kim Lim is delivering food to frontline medical workers weekly to thank them for their hard work. 14 April 2020. See <https://www.8days.sg/sceneandheard/celebrities/billionaire-heiress-kim-lim-is-delivering-food-to-frontline-12641662>.

<sup>33</sup> For more details on the external operations and its logistics base in SGH, see chapters 8 and 9.

<sup>34</sup> For more details on perimeter screening, see Chapter 4.



Kindness is a multi-way street. Many primary school children were encouraged (or inspired) to create artwork depicting their appreciation for the efforts of healthcare workers. SGH received its share of these creations.





## CHAPTER 7

# Flying The Flag

Diagnosed with COVID-19, many faced fear and anxiety, yet we saw courage and selflessness in so many of our patients as they willingly volunteered to participate in the COVID-19 studies, donating their blood and respiratory samples so that we could learn about the novel pathogen. Patients often told us that they wanted to do something to help, and perhaps even contribute to finding a cure or a vaccine. Many patients returned to the hospital to donate convalescent blood samples months after they recovered, allowing us to study the long-term immune response to infection. It was humbling to have the support of our patients – it truly made all the hard work worthwhile.

**JENNY LOW AND  
SHIRIN KALIMUDDIN**

Senior Consultant and Consultant,  
Department of Infectious Diseases

In June 2020, SGH clinicians and Duke-NUS Medical School scientists published one of Singapore's earliest COVID-19 scientific papers<sup>1</sup>, detailing the host response to severe disease. Many more publications have followed since, and SGH continues to contribute to scientific understanding of COVID-19, especially in the area of vaccine and therapeutic development. Yet, this success was not pure serendipity.

Infectious Diseases (ID) physicians Shirin Kalimuddin<sup>2</sup> and Jenny Low<sup>3</sup> described the efforts that bore much research fruit in the pandemic.



The Duke-NUS Medical School is sited within the grounds of SGH Campus.

<sup>1</sup> Ong EZ et al. A dynamic immune response shapes COVID-19 progression. *Cell Host Microbe* 2020;27: 879.

<sup>2</sup> Dr Shirin Kalimuddin, Consultant, Department of Infectious Diseases, is a recipient of a Transitional Award from the National Medical Research Council (NMRC).

<sup>3</sup> Dr Jenny Low, Senior Consultant, Department of Infectious Diseases. She is an established clinician-scientist whose work is supported by the NMRC.

## PREPARE YOUR UMBRELLA BEFORE IT STARTS TO RAIN

The SARS crisis of 2003 taught us that we needed to be better prepared for the next big outbreak. During SARS, the healthcare system was overwhelmed by clinical workload and the challenges of an epidemic that few had anticipated. Faced with more pressing tasks at hand, little resources were dedicated to basic research. As a result, precious opportunities to learn about the new illness through research were lost. This deficiency weighed heavily on the mind of ID physician Tan Ban Hock<sup>4</sup>, then a consultant with the Department of Internal Medicine (DIM). When the Department of Infectious Diseases (DID) was formally constituted in 2008, a conscious effort was made to build research capability within the department.

Drawing upon lessons from SARS and the H1N1 pandemics, a prospective “Novel Pathogens Research Protocol” was developed by Ban Hock and Jenny, the latter then a budding clinician-scientist. Under this umbrella protocol, patients in SGH could be recruited prospectively, and their samples collected systematically, during any infectious disease outbreak. In 2016, the protocol allowed the rapid recruitment of patients during the Zika outbreak. The protocol, which had been developed in peacetime and was hence subjected to lengthy reviews by the Institutional Review Board (IRB)<sup>5</sup>, allowed for a plug-and-play approach the moment COVID-19 landed on our shores. By November 2020, more than a hundred COVID-19 patients in SGH had been recruited via the protocol. Data and samples collected have led to new insights into COVID-19 pathogenesis and the host immune response to the virus.

### Alone we can do so little; together we can do so much

Unlike the Edward Jenners and Alexander Flemmings of the past, researchers of today can no longer work in silos. Almost all of SGH's COVID-19 research output has been the result of multi-institutional collaborations with academia and with partners, both locally and overseas. We partnered Duke-NUS and industry to lead the first-in-human trials of a COVID-19 self-replicating mRNA vaccine and a novel therapeutic monoclonal antibody<sup>6</sup>.

<sup>4</sup> Dr Tan Ban Hock, Senior Consultant, Department of Infectious Diseases. He was the first Head of Department.

<sup>5</sup> The IRB is a body that reviews, approves and audits all research in an academic institution for compliance with national regulations and ethics guidelines.

<sup>6</sup> The writers refer to clinical trials of the vaccine produced by Arcturus Pharmaceuticals, as well as of the monoclonal antibody produced by Tychan Pte Ltd. Dr Jenny Low was the lead investigator for both.

We were also an active participating site in several multinational COVID-19 clinical trials<sup>7</sup>. Yet, many of these collaborations began long before the start of the outbreak.

Since the establishment of Duke-NUS Medical School in 2005, SGH has built and maintained strong collegial ties with the Programme in Emerging Infectious Diseases, one of the school's signature research programmes. Over the past decade, ground-breaking translational research on re-emerging viruses (such as dengue and yellow fever) impressed funders and led to the establishment of the Viral Research and Experimental Medicine Centre (VIREMICS) at the SingHealth Duke-NUS academic medical centre. This Centre has played a pivotal role supporting clinical trials and research throughout this COVID-19 outbreak. These established links enabled both clinical and bench researchers to dive into their critical roles even before Singapore's first COVID-19 patient.

### It takes a village

During the outbreak, COVID-19 research in SGH progressed at a relentless pace. The clinical trial evaluating the antiviral remdesivir took less than four weeks from conception to site initiation, something unheard of in peacetime. Author lists on publications and reports in the media often fail to acknowledge the large team of individuals working faithfully behind-the-scenes to make research possible.

It is not possible to name everyone, but we would be remiss not to give significant credit to the Clinical Research Coordinators (CRCs) from DID (Natalie Lee<sup>8</sup>, Christina Titin<sup>9</sup> and Sam Huizhen<sup>10</sup>), teams from the SGH Clinical Trials Research Centre, SingHealth Investigational Medicine Unit, and the SGH Research Office.

### JENNY LOW AND SHIRIN KALIMUDDIN

Senior Consultant and Consultant,  
Department of Infectious Diseases

<sup>7</sup> SGH was a site in the remdesivir studies sponsored by the international pharmaceutical giant, Gilead. The site principal investigator was Dr Shirin Kalimuddin.

<sup>8</sup> Natalie Lee, Clinical Research Coordinator, Department of Infectious Diseases.

<sup>9</sup> Christina Titin, Clinical Research Coordinator, Department of Infectious Diseases.

<sup>10</sup> Sam Hui Zhen, Clinical Research Coordinator, Department of Infectious Diseases.

During the outbreak, many people stepped up to serve, often venturing out of their comfort zones and going beyond the call of duty. Despite stressful work conditions and heavy clinical volumes, staff were ever ready to assist the research teams. Clinical research was made even more challenging given the strict infection control protocols in place. Consent forms could not be removed from the isolation rooms, and samples had to be meticulously wiped down and triple-bagged before they were transported out. Without the assistance of dedicated clinical staff, it would have been almost impossible to carry out research in the isolation ward (IW).

Junior doctor Shivani Durai<sup>11</sup> volunteered to assist with COVID-19 research (something beyond her clinical duties), and spent long hours in the IW recruiting patients and collecting research specimens. Shivani explained why she volunteered. "I felt deeply moved when I saw a vast majority of my friends selflessly fighting on the frontlines. I thus decided to work in research to tackle the disease and hopefully make a difference. I believed that was the right thing to do as a doctor and as a fellow Singaporean."

<sup>11</sup> Dr Shivani Durai, Senior Resident, Department of Obstetrics and Gynaecology.

Research Coordinator Natalie Lee shared her thoughts. “It was truly a once-in-a-lifetime experience. Being on the frontlines during the pandemic as a Clinical Research Coordinator highlighted the importance of research where time was of the essence. That made me see the importance of the role I played. Working amidst the chaos, with fast changing rules, while ensuring that all precious research samples were collected and research protocols were adhered to – it was challenging yet extremely thrilling. Even though everyone was overwhelmed, we helped each other out whenever we could, so no one would be left behind.”

Her colleague Christina Titin added. “The period from April to May 2020 when we had many patients in the remdesivir trials was an extremely busy time. We delivered drugs to the ward and ensured that nurses administered them on time. Moreover, we had to make sure that all tests and assessments were done according to the clinical trial protocol, not forgetting the piles of data that needed to be entered. I was thankful for the colleagues around, who lifted our spirits. Check-ins like ‘Are you ok?’ from people around felt so comforting.”



Staff donating blood for COVID-19 research into antibodies following vaccination. The study began in 2021.

One memorable experience was having to recruit healthcare workers for a COVID-19 related study. At first, my colleague and I had difficulty publicising our study. But with a stroke of luck, news of our study spread by word of mouth and suddenly we had nurses from wards 68 and 67, staff from outpatient clinics, even doctors from the labs calling us and expressing interest. We felt like we had won the lottery. We were overjoyed and grateful, knowing that they did it with the pure intention of helping with research. Moments like these make me feel like our efforts have paid off. It has been a tough year, but it has also been one of the most rewarding.

Sam Hui Zhen, Clinical Research Coordinator, Department of Infectious Diseases

## MEDICAL STUDENT EDUCATION – NOT LEFT TO LANGUISH

When the first case was confirmed in Singapore, we grappled with the dilemma of whether to continue the medical student clinical postings; at what scale, which posting; how to continue safely, and how to craft a robust surveillance system to track the well-being of the students. Maintaining constant, open and timely communication with the medical schools helped us feel our way forwards. It was imperative to keep all stakeholders, including the students, updated on the latest measures.

For a start, all incoming clinical electives for the period January 2020 to August 2020 were cancelled. This was to ensure the safety of inbound students.

The situation evolved fast and furious. It was a race to keep up with, and implement, the various guidelines from MOH, SGH and the medical schools. We had to be nimble, consistent and coherent in our response to the evolving situation. Clinical medical education ceased once Singapore went into DORSCON Orange<sup>12</sup>. Faculty had to rapidly adapt and provide live-streamed clinical teaching and online lectures. When students were allowed in the wards, we had to carefully manage the numbers to avoid overcrowding. We had to reduce workplace-based assessments. But the academic examinations continued — it was important to maintain the pipeline of junior doctors.

### DR TAY SOOK MUAY

Senior Consultant,  
Department of Anaesthesiology

*She served as Associate Dean for the National University of Singapore Yong Loo Lin School of Medicine, SGH Campus, from 2012 to 2021.*

<sup>12</sup> Singapore raised the risk assessment level to DORSCON Orange on 7 February 2020 after the appearance of local cases without links to previous cases or travel history to China.

## Organ transplant during the pandemic

For the members of SGH's various transplant teams, closing their programmes was not an option. Transplant specialists Jasmine Chung<sup>13</sup>, Tan Ek Khoon<sup>14</sup> and Terence Kee<sup>15</sup> recounted the uncertainty in February 2020. "As the then Wuhan virus made its way around the world, and as a slew of new work protocols unleashed themselves on us, the first response was to suspend all transplant activity<sup>16</sup>.

"SARS veterans among us, however, felt that the SingHealth Duke-NUS Transplant Centre (SDTC) should come together and talk our way through the morass of clinical and ethical conundrums. In 2003, many had witnessed the "second victims" of SARS – patients who presented with advanced cancer or whose diabetes had spun out of control because they had put off consulting a doctor about their symptoms, for fear of catching the virus.

"In February 2020 (an era before virtual meetings), we gathered a few times, usually starting at 7:30am, to discuss the options. We all knew, from bitter experience, that a steady trickle of patients became ineligible just waiting for a transplant – heart candidates sometimes developed a stroke, liver candidates saw their cancers spread, and lung candidates expired from lack of oxygen. Suspending the programme would clearly prolong the wait, and turn the trickle into a torrent. The ethics seemed straightforward in favour of carrying on, but wait. Would the transplanted organ itself bring the virus into the recipient? Would our staff catch the virus operating on an asymptotically infected patient?

<sup>13</sup> Dr Jasmine Chung, Consultant, Department of Infectious Diseases. She is one of three ID physicians in SGH who serve on the various transplant programmes in SingHealth.

<sup>14</sup> Dr Tan Ek Khoon, Consultant, Department of Hepato-pancreato-biliary and Transplant Surgery.

<sup>15</sup> Dr Terence Kee, Senior Consultant, Department of Renal Medicine. He is also Programme Director, Renal Transplant Programme, SGH.

<sup>16</sup> The Straits Times. Organ transplants, donations hit by COVID-19. 7 June 2020 [Internet]. Available at: [www.straitstimes.com/singapore/health/organ-transplants-donations-hit-by-covid-19](http://www.straitstimes.com/singapore/health/organ-transplants-donations-hit-by-covid-19).

“The proposed way out seemed sensible enough – evaluate a potential donor carefully, and test him/her for the virus several times. This seemed a rational strategy, but it could not be backed by published evidence. The West, always a rich source of evidence, had not yet been hit by the virus, and was carrying on with life as usual. The first two cohorts described by the Wuhan doctors had not included transplant recipients or candidates. The data-driven among us wanted to know the accuracy of the new diagnostic tool, but of course no such information was available. Everyone was learning about the virus.

“Somehow we managed to agree to keep the transplant programme going. It fell upon the Transplant ID team to draw up the protocols. This proved less daunting than imagined – there was little literature to quote, just common sense to exhibit.

“We were glad to have had the support of senior management, and happy when MOH officially allowed most types of transplants to proceed. We went on to contribute to the MOH guidance on transplantation in the pandemic.

“At the end of March 2020, with the nation in DORSCON Orange, and days before the Prime Minister appeared on TV to announce a national lockdown, we were offered organs from a brain-dead donor. SGH’s liver and lung programs put ourselves through the paces of our own protocols, and carried on with the transplants<sup>17</sup>.”

The transplant team published their experience in an academic journal<sup>18</sup>.

<sup>17</sup> These two transplants went well. Neither recipient caught COVID-19. Both have gone back to leading normal lives.

<sup>18</sup> Chung SJ et al. Practical considerations for solid organ transplantation during the COVID-19 global outbreak: the experience from Singapore. *Transplant Direct* 2020;6:e554.



## A GIFT OF LIFE DURING THE PANDEMIC

(excerpts from Singapore Health<sup>19</sup>)

In March 2020, Mr Koh Khim Teck became one of the first patients to receive a transplant during the COVID-19 pandemic.

His condition took a turn for the worse when his liver cancer stopped responding to treatment, and a transplant became critical. Mr Koh was able to undergo the life-saving procedure because of revised transplant guidelines developed during the disease outbreak.

A lack of viable organs and a long waitlist already made it hard for patients to get a suitable organ. With the virus outbreak, the concerns of infection added to the risks associated with a transplant. But for SGH transplant specialists, closing the service was not an option.

“COVID-19 could last for months or even one to two years. If we do not think and plan ahead, patients may fall off the waitlist and die from disease progression,” said Dr Jasmine Chung.

Nevertheless, patients are often willing to take the risk. According to transplant surgeon Prema Raj<sup>20</sup>, 83% of patients who are on the wait list expressed willingness to continue with the transplantation during the pandemic<sup>21</sup>.

“The key is speaking to patients because they are the ones who are sick; they are the ones who will receive the organs. For someone who has end-stage lung disease or end-stage liver cancer, the potential for a change in life is tremendous. So once we know our patients are keen, we physicians have to make it as safe as possible for them,” said Dr Raj.

<sup>19</sup> This story was first published as “A gift of life during the pandemic”, in Singapore Health Nov/Dec 2020, a SingHealth patient education newsletter.

<sup>20</sup> Dr Jeyaraj Prema Raj, Senior Consultant, Department of Hepato-pancreato-biliary and Transplant Surgery. He is also Director, Liver Transplant Programme, SGH and Director, SingHealth Duke-NUS Transplant Centre.

<sup>21</sup> For the survey on wait list candidates’ attitudes to transplantation during COVID-19, see Tan EK et al. Waitlisted transplant candidates’ attitudes and concerns toward transplantation during COVID-19. *Ann Transplant* 2020;25:e926992.

## STILL OPERATING

When the virus first touched down in SGH, we scrambled to equip our Operating Theatre (OT) on-call team with protective gear, knowing that they would be at the frontline managing the airway of suspect cases requiring intubation. We were fortunate to have SARS veterans among our anaesthesiologists and nurses who provided valuable advice and initiated on-the-spot training for the young doctors going on-call that same night.

With the immediate concerns addressed, we next focused on the main principles to prioritise the safety of our patients and staff in the face of a new unknown, a potentially deadly pathogen. These principles were: segregation by location, segregation by workflow, and protective equipment.

### Segregation by location

The Urology Centre's OT were a natural choice for an isolation OT complex due to their distance from the major OT complex. Unfortunately, there were limitations, mainly because of their size. Surgeons and anaesthesiologists of all disciplines were invited to view the site for suitability for their specialty-specific needs. We carried out in-situ simulation to see if the Urology OT would be able to accommodate cardiac surgery and obstetric surgery, among others. With the support of the Medical Board, we re-configured the entire Urology OT complex as the isolation operating facility for SGH.

### Segregation by workflow

This was a key aspect of our management. First, we had strict criteria to screen patients deemed to be at risk of having the virus. Then we had a workflow to keep suspect patients separate from other patients. We also had a workflow to segregate staff caring for suspects from those caring for other patients.

All patients were screened for travel and contact history, as well as the presence of signs and symptoms of the infection. There were numerous calls to our ID colleagues to seek advice on risk stratification. Sometimes we had lengthy debates on the suitability of using the isolation OT for the patient in question.

Developing and then promulgating the isolation OT activation workflow were critically important because all processes were new. Efficiency fell, mainly because equipment had to be brought from other OTs. There were also new factors that needed to be accounted for, such as the availability of security escorts<sup>22</sup>. Our staff found the team brief and debrief very useful. In the early days, a coordinator (usually the Anaesthesiology consultant on-call that day) was assigned to guide staff and to facilitate the smooth running of the case. In situ simulation helped us to identify unanticipated problems; we uncovered many small details that we might otherwise have overlooked.

### Protective equipment

As anaesthesiologists, we knew that our daily work with the airway involved the highest risk of exposure to respiratory secretions, an obvious source of virus. The department was quickly fitted with N95 masks and our Powered Air-Purifying Respirator (PAPR) super-users spent days training every member of staff in the use of the different models available in SGH. Emphasis was also placed on safe doffing of personal protective equipment (PPE), in order to prevent transmission to our colleagues and patients.

As the virus made its way around the world, we saw more and more countries go into lockdown as their healthcare systems were ravaged by the surge in COVID-19 patients. This heralded a supply chain issue for Singapore as we faced delays in the shipment of necessary medical supplies. April 2020 was a particularly intense period when we had to source for alternative supplies while worrying about an upswing in the number of critically ill patients. The Sterile Supplies Unit (SSU), under the leadership of nurse Goh Meh Meh<sup>23</sup>, came up with ways to sterilise single-use consumables, in the event that this became necessary. Pharmacy and nursing performed weekly stock checks to make sure that we had the drugs we needed. Our technicians used their intimate knowledge of our equipment to come up with innovative solutions to utilise existing resources to replace what we lacked. This was a commendable multi-disciplinary effort – so many people came up with ways to get around problems you'd never thought would emerge!

<sup>22</sup> Security escorts were needed to clear the path and manage the lifts so that no one would inadvertently come into contact with a patient/suspect being transported. Read more about this process in Chapter 1.

<sup>23</sup> Goh Meh Meh, Deputy Director Nursing, oversees the SSU which cleans and sterilises tools and equipment used for surgery.

In spite of the pandemic, then, OT life went on. Patients still had fractures, cancer, and needed surgery. With solid plans in place, we were able to confidently and simultaneously care for suspects as well as business as usual (BAU) patients (the latter in our main OT complex). While many elective operations were postponed during the Circuit Breaker<sup>24</sup> to allow manpower to be diverted to the migrant worker dormitories<sup>25</sup>, time-sensitive operations such as cancer surgery were allowed to proceed.

But there was an air of impermanence. One day we had to resume full services, and return the Urology OT to the urologists. This would not be possible as long as COVID-19 lurked in some dark corner. The critical problem was that operating rooms were positively-pressured, meaning air was always pumped out of the operating room. This meant that cases/suspects could not be operated on there while life continued outside.

Our colleague Hairil Abdullah<sup>26</sup> chewed on this problem and came to the rescue. Teaming up with a local biomedical incubator, he created a System of Portable AnteroRoom for Containment (SG-SPARC).

With SG-SPARC, we were able to safely co-locate the isolation OT within the major OT complex without worry of disease transmission. Units of the device are now placed at the doors of a few of our operating theatres, enabling anyone with confirmed or suspect COVID-19 to undergo surgery without risk to the staff.

**JOLIN WONG**

Consultant,  
Department of Surgical Intensive Care

*She was the Infection Prevention Liaison Officer (IPLO) in the Division of Anaesthesiology and Peri-operative Medicine.*

<sup>24</sup>The Circuit Breaker lasted from 7 April to 1 June 2020, when the population was required to stay home.

<sup>25</sup>For details of SGH Campus' operations at the dormitories, see Chapters 8 and 9.

<sup>26</sup>Dr Hairil Abdullah, Senior Consultant, Department of Anaesthesiology and Director, Perioperative Services.

**NEGATIVE PRESSURE ISOLATION ROOMS IN AN HOUR**

SG-SPARC is a portable negative pressure anteroom system that, in one hour, transforms a room into a negative pressure isolation room. The box-like SG-SPARC, with its double interlocking doors, can be installed at the entrance. After installation, all gaps are sealed. The negative pressure system allows air to come out of the room where the patient is but prevents contaminated air aerosols from flowing into the corridor. A high efficiency particulate absorbing (HEPA) filter cleanses the air before expelling it to the exterior. Air that is sent back to the patient's room is also HEPA-filtered first, so that only clean air enters the patient's room.

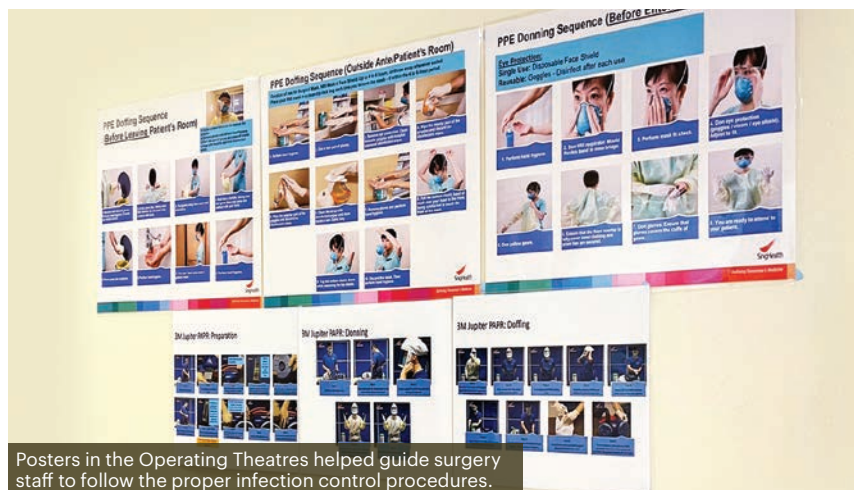




OT nurse Marhaini Binte Hamid<sup>27</sup> recounted preparations to turn the Urology OT into an isolation OT. “During this period, a lot of planning and preparation work was carried out. Our orthopaedic nursing team created a portable tote box containing sterile consumables and supplies, to permit emergency surgery on COVID-19 positive or suspect patients.

Frequent scenario simulations were carried out to familiarise everyone with the planned workflow. Infection control measures were of key importance to prevent cross-contamination.

Days passed, and then one day, I was informed of a suspect requiring emergency surgery. Even after going through several simulations, it was nerve-racking to be thrust into the very frontline. A team brief was carried out, and the nurses, the surgeons, the anaesthesiologist and a coordinator reviewed the steps we would take. I was glad for all the posters in the OT giving guidance on all sorts of procedures – how to dispose of soiled PPE, for example. The episode strengthened bonds among members of the surgical team.”



<sup>27</sup> Marhaini Binte Hamid, Assistant Nurse Clinician, Operating Theatres.

—●—

*The single most important lesson  
I have learnt from this  
pandemic is that people  
are our biggest asset.*

*There is an incredible amount of  
talent, creativity, resilience and  
dedication amongst our staff.*

*We can only achieve what we set out  
to do when we galvanise everyone  
towards a single cause, remembering  
that patients are at the heart of all  
we do.*

—●—

**JOLIN WONG**  
Consultant,  
Department of Surgical Intensive Care  
*She was the Infection Prevention Liaison Officer (IPLO)  
in the Division of Anaesthesiology and Peri-operative Medicine.*

## CHAPTER 8

# Into The Crucible

“Lionel, I need your help!”

It was 9:00am on Saturday, 11 April 2020, when my phone flashed “unknown caller”. Thinking it was an unsolicited sales call, I was about to launch into an anti-telemarketing barrage when I was greeted by the most polite voice. It was SGH CEO Kenneth Kwek. There was no way I would refuse him. The situation was dire. My life was going to change abruptly.

**LIONEL CHENG**

Senior Consultant,  
Department of Diagnostic Radiology

The COVID-19 situation in the migrant worker dormitories<sup>1</sup> was getting out of control, and a national response had been mobilised. An inter-ministry Joint Task Force (Assurance) [JTF(A)] was being put together. Lionel would be SingHealth's alternate point-of-contact (POC), assisting medical administrator Edwin Low<sup>2</sup> as the lead POC.

Singapore had just announced a Circuit Breaker<sup>3</sup> a few days before, on 7 April 2020, as the nation recorded a daily high of 120 new cases. As community cases rose, an outbreak likened to relentlessly exploding land mines was taking place in many densely packed migrant worker dormitories that dotted the country. Cases first started in Pulau Punggol Timor Lodge 1B (subsequently dubbed "S11@Punggol"), a huge dormitory on a reclaimed island along the north-eastern edge of Singapore.

Even as SGH struggled to ride the whirlwinds of change in the hospital, we now had to respond to the nation's call to provide medical support outside our four walls. The summons for us to get out of our comfort zone and help manage the increasing eruptions in the dormitories was unprecedented, but a crucial plank of the whole-of-nation response.

Within hours of activation, our tasks – in broad strokes – reached us from the upper echelons of the nascent JTF(A). SingHealth would be the primary healthcare provider for an estimated 98,000 migrant workers living in 15 purpose-built dormitories (PBDs)<sup>4</sup>. SGH Campus<sup>5</sup> would take care of

<sup>1</sup> In 2020, 54,505 out of the 58,320 infections were migrant workers living in dormitories, according to a Ministry of Manpower press release dated 14 December 2020.

<sup>2</sup> Dr Edwin Low, Director, Programme Development, SingHealth Office of Regional Health.

<sup>3</sup> The Circuit Breaker from 7 April 2020 to 1 June 2020 was the term used for Singapore's partial lockdown.

<sup>4</sup> There were several types of migrant worker dormitories in Singapore. These included large Purpose-Built Dormitories (PBDs) which could house several thousand workers, mid-sized Factory Converted Dormitories (FCDs) for up to a few hundred workers, and small Construction Temporary Quarters (CTQs) at worksites. The external operations mounted by SGH focused on PBDs.

<sup>5</sup> SingHealth operates out of four campuses. SGH is co-located with four national specialty centres – National Cancer Centre Singapore, National Dental Centre Singapore, National Heart Centre Singapore, and Singapore National Eye Centre. For the purposes of external operations, the National Neuroscience Institute (NNI), which runs the Departments of Neurology and Neurosurgery in SGH, also contributed to SGH Campus efforts.

eight dormitories as well as support swab isolation facilities (SIFs) – hotels converted to isolation compounds for patients awaiting the results of a swab test – and deploy mobile swab teams. By virtue of size, SGH Campus would be expected to contribute a significant proportion of personnel and resources.

### Sunday, 12 April 2020: the first foray

The next day, staff from four SGH Campus institutions – the National Cancer Centre Singapore (NCCS), the National Dental Centre Singapore (NDCS), the Singapore National Eye Centre (SNEC) and SGH – mounted their first swab operations outside of the hospital, assisted by personnel from the Singapore Armed Forces (SAF). The mission was to start testing about 20,000 seemingly healthy migrant workers so that they could be quickly cleared to carry on working in essential services. These workers were being extracted from their dormitories across Singapore and moved to 21 blocks of disused public flats at Redhill, barely two kilometres from SGH.



Staff of SGH Campus carried out its very first mobile swab operation at Redhill on 12 April 2020.

## SWABBING THOUSANDS

At that time, we thought it was a one-off thing for the migrant workers. We knew it was going to be a large number but didn't know how it would unfold. The largest number swabbed at a single time then was just a few hundred.

That Easter Sunday morning, while walking to the Redhill site, I saw cranes lifting mattresses through the windows of the empty HDB flats. These workers had been relocated at short notice. There was apprehension all around.

The SAF had set up a tent for us. They were registering the workers for us, getting them ready to be tested. All we had to do was swab and label the specimens, and send them off to the lab.

It was a colossal operation, and the choke point was at registration, which was done manually. Each swab took just a few minutes. After the swab, there were again long queues, this time to collect care packs containing SIM cards. So, the SAF had to deploy manpower over there too – they were running all over the place.

Thanks to NDCS, 40 dentists and nurses came to our aid, and we managed more than 1,500 swabs over six hours that day. That record became the benchmark.

In the midst of the sweltering heat as the swabbers worked outdoors in full personal protective equipment (PPE) – disposable gowns, gloves, N95 masks and goggles – SGH and SingHealth leaders turned up offering support, including a surprise bubble tea treat. CEO Kenneth Kwek gave me \$500 cash to buy drinks. After paying for them, I had a few hundred dollars left. "How do I return this to CEO?" I wondered, naively thinking that the swabbing was going to last only a few days.

### LIM CHIN SIAH<sup>6</sup>

Consultant,  
Department of Emergency Medicine

*He led the launch of the mobile swab operations.*

<sup>6</sup> Dr Lim Chin Siah, Consultant, Department of Emergency Medicine, had served in the past with Doctors Without Borders or Médecins Sans Frontières, the international medical humanitarian organisation.

## Planning for the outposts – HQ quandaries

The fog of war was pervasive as Edwin and Lionel, both former regulars with the SAF Medical Corps, tried to figure out what exactly was required of them in their new roles. Public healthcare institutions were not configured for such sudden and large-scale mobile operations. Even while they plotted the deployment strategy based on the instructions given, details remained scant. It was not a well-rehearsed deployment like the usual SAF In-Camp Training (ICT)<sup>7</sup> with a reservist unit, and there was no battle-tested model to follow. Lionel reflected on the experience. "We didn't know exactly what we needed to do, but we knew we had to do something soon. We were literally building the boat, sailing and fighting the battle, all at the same time."

Surgeon Puah Ken Lee<sup>8</sup>, who was the deputy medical lead at S11@Punggol dormitory, put it in perspective. "This was the closest that most of us would come to an actual humanitarian and disaster relief operation. There were some key differences though. This was not an earthquake in a remote region miles away from home. We could bring the virus back to our loved ones, putting our families and the general community around us at risk. Therefore, what's at stake was not just ourselves, but everyone else we were in contact with."

The team was given 72 hours to deploy the first Mobile Medical Team (MMT) to the workers' dormitories, upon receiving the ops orders<sup>9</sup> on Saturday, 11 April 2020. The next day, after witnessing the mass swabbing operations at Redhill, they developed an initial plan to push out the first wave of

<sup>7</sup> All male Singaporeans are required to serve full time national service (NS) for two years, after which they return to normal civilian life as operationally-ready NSmen. During this time, they may be recalled for annual refresher training or operations, usually lasting up to two weeks. These annual sessions are referred to as in-camp training.

<sup>8</sup> Dr Puah Ken Lee, Consultant, Department of Orthopaedic Surgery.

<sup>9</sup> "Ops orders" is military lingo for Operations Order, or to the layman, instructions from headquarters for the mission at hand.

the MMTs by Monday, 13 April 2020. This rough and tumble deployment plan was shared during the first online briefing to the hospital leads on Sunday morning, 12 April 2020. Lionel recalled how that first meeting was disrupted by problems with internet bandwidth. “We could barely see and hear each other during that first teleconference with all the SingHealth leads, but somehow the message got through.”

DORMITORY	RECCE
Tampines Lodge	Done ✔ SHP team deployed
Homestay Lodge	13 Apr 10:00am ✔ SGH
Avery Lodge	13 Apr 8:00am ✔ SGH
Shaw Lodge	13 Apr 11:00am ✔ KKH
The Leo	13 Apr 2:00pm ✔ SGH
Changi Lodge 2	13 Apr 12:30pm ✔ CGH
Cassia at Penjuru	13 Apr 3:00pm ✔ SGH
Jurong Penjuru 1	13 Apr 5:00pm
SSKBJV Dormitory	14 Apr 8:00am
Central Staff Apartments	14 Apr 10:00am
Brani Residence	14 Apr 12:00pm
Pasir Panjang Residence	14 Apr 2:00pm

This table, modified for publication, was presented on a slide at the first online briefing on 12 April 2020. It showed the scope and urgency of deployment for the external operations.

The initial leads tasked with mounting the SGH Campus response were surgeons Tan Hiang Khoo<sup>10</sup>, Tan Mann Hong<sup>11</sup> and Chan Chung Yip<sup>12</sup>. There were difficult online discussions as they grappled with the ever-growing commitment needed from SGH Campus. SGH leadership was very concerned about safety as teams would be entering a hot zone – one very different from the usual sterile hospital environment – with a high risk of exposure to the virus and a markedly increased heat load due to PPE requirements.

Many questions on the mission remained unanswered. What exactly were they supposed to do? How long was the deployment? How much PPE should they don? How would they eat or drink? Was it safe for them to use the toilets?

No one had all the answers or knew all the requirements for starting and running a medical post in the dormitories. JTF(A), too, was developing the protocols on the fly. The SGH leads had to use their judgement, make do with the little information that they had, and improvise along the way. Every decision was part of a Plan-Do-Check-Act (PDCA) cycle that was repeated endlessly. The priority was to keep staff safe, while ensuring mission success. Nurse Janice Yee<sup>13</sup>, who served stints in both the mobile swab team and the MMT, echoed everyone’s concern. “The key thing on my mind was infection control and ensuring the safety of the team.”

Each decision made on the JTF(A) WhatsApp chat group would cascade down through the SingHealth Medical Operations Cell<sup>14</sup> to the SGH leads, resulting in multiple layers of scrambling. Everyone down the line had to react quickly and mobilise additional resources to make things happen.

<sup>10</sup> Dr Tan Hiang Khoo, Chairman, Division of Surgery & Surgical Oncology, SGH and NCCS.

<sup>11</sup> Dr Tan Mann Hong, Chairman, Division of Musculoskeletal Sciences.

<sup>12</sup> Dr Chan Chung Yip, Head and Senior Consultant, Department of Hepato-pancreato-biliary and Transplant Surgery.

<sup>13</sup> Janice Yee, Senior Enrolled Nurse, Specialist Outpatient Clinics.

<sup>14</sup> The SingHealth Medical Operations Cell was the group responsible for processing instructions and policies from JTF(A), and then reframing and distributing the tasks across all SingHealth teams at various locations. It was staffed by personnel from multiple SingHealth institutions.

## Just do it

**It was late afternoon on Easter Sunday when I was alerted. We needed to supply one Pharmacy Technician per MMT and we could be looking at deploying six MMTs progressively starting from Monday. We had to get the medications packed... all to be ready in less than 24 hours!**

Lee Soo Boon, Deputy Director, Pharmacy

The Pharmacy team quickly modified the medication list developed for the Fever Screening Area<sup>15</sup> already operating in SGH. They also had to check out the deployment sites to set up a proper workflow – including infection control, proper drug storage out of direct sunlight, as well as a secure area to store and lock the medications overnight.

The Operations team from SGH outpatient clinics was asked to provide the logistical support for the MMTs. Manager Poonam Vas Dec Bajaj<sup>16</sup> recounted. “Within hours, consumables poured in quickly with help from our colleagues in the store. The Pharmacy team came in lightning fast with medications for 200 patients. Medical equipment was pulled from locations across SGH. We moved mountains and made it happen. Details were scarce but the task was urgent.”

Her colleague Christina Tan<sup>17</sup> had to configure the teams quickly. “I had to activate four teams of six admin staff each to be deployed by the next morning. Are they mask-fitted? What languages do they speak? As the MMTs would operate seven days a week, I could not pick people from the same work area. By the time I was done, it was almost midnight. And by 7:00am, I was at the MMT logistics base at Bowyer Block to meet and brief the staff.”

<sup>15</sup> For more details of the Fever Screening Area, see Chapters 1 and 4.

<sup>16</sup> Poonam Vas Dec Bajaj, Senior Manager, Specialist Outpatient Clinics – Operations.

<sup>17</sup> Christina Tan, Senior Operations Executive, Specialist Outpatient Clinics – Operations.

## Tuesday, 14 April 2020: entering the trenches

In the end, deployment to the dormitories was pushed back by a day to enable careful reconnaissance of the actual locations. Tuesday morning, 14 April 2020, came, and the first MMTs set out into unknown territory. They went to four dormitories – Avery Lodge, Cassia@Penjuru, Homestay Lodge and The Leo. Lionel remarked. “The immense courage these initial teams displayed, diving straight into the mayhem, cannot be overstated.”

Nurse Vir Kaur Gill<sup>18</sup>, a SARS veteran, was deployed without notice to one of the dormitories. “Early on Tuesday morning, I received a call to report for a short briefing and the next minute I was in scrubs ready to head to the dormitories. I did not bring my toiletries nor a change of clothes, but I made do with what I had.”

Forming the MMTs for the dormitory deployments was no mean feat. The teams had to be self-sufficient for manpower resources and logistics, and learn to perform the oral and nasal swabs proficiently. Doctors, nurses, pharmacists, pharmacy technicians, allied health professionals and administrative support members were extracted from tertiary sub-specialised hospital environments and parachuted into austere conditions at the dormitories.



Buses in formation outside Bowyer Block ready to ferry staff to the dormitories. A staff member commented that they looked like armoured vehicles at the start of military operations.

<sup>18</sup> Vir Kaur Gill, Nurse Clinician, Specialist Outpatient Clinics – Operations.

## BASE CAMP

Everybody ran on pure adrenaline in the initial days. Although the MMTs did not have to operate overnight, they had to maintain full day (morning till evening) operations seven days a week. This meant an early arrival at SGH Campus to get ready. The SGH LIFE centre was converted to a central logistics and coordination headquarters for the medical teams. Each morning, the teams would gather here to change into scrubs, top-up medical equipment and supplies, and have a final briefing before heading off to their respective dormitories. After their mission in the dormitories, they would return to SGH to wash up and have the daily debrief before departing for home.



SGH Campus teams at their morning briefing.



The bustle of activity inside the logistics base at Bowyer Block where MMTs stocked up supplies and got things ready for the day.



Dedicated areas were marked out for each MMT, allowing them to customise the supplies they needed for the day. These would then be loaded onto buses which brought the teams to the respective dormitories.

## Thursday, 23 April 2020: another front opens

A week after scrambling to launch the external deployment on 12 April 2020, SGH received an ops order to set up a hotel Swab Isolation Facility (SIF)<sup>19</sup>. These hotel SIFs would have substantial capacity to isolate people awaiting swab results – they had plenty of single rooms with en suite toilets. The first assignment was the nation's largest SIF – the 790-room Village Hotel@Sentosa. On 23 April 2020, this SIF took in its first patients.

A few days later, the SGH team was also given command of the 400-room Concorde Hotel. It became the second SIF that was operationalised, on 1 May 2020.

It felt like we were walking into our new role with blinders on, full of questions about the whole operation.

Karen Shiu, Senior Manager, Specialist Outpatient Clinic – Operations  
*She was deployed to the SIF at Concorde Hotel.*



The enormous carpark of Village Hotel@Sentosa was converted into a mobile clinic. This 790-room facility managed by the SGH Campus team was the largest SIF in the national response plan.

<sup>19</sup> Workers who were swabbed by dormitory medical teams were sent to SIFs to await their swab results. Each dormitory had a small SIF on site usually with communal toilet facilities. The hotel SIFs had substantially greater holding capacity, and also en suite toilets for each room which were more suited for isolation purposes.

Every day, migrant workers would arrive by the busload. They needed quick assessment and processing before being sent to their rooms for isolation.

Nurse Choo Xiu Hui<sup>20</sup>, with both to MMT and SIF Sentosa experience, said reflectively. “There was no established protocol on how an SIF should be run. We initially donned PPE and went room by room, checking on the migrant workers. Patient screening was subsequently conducted in the SIF carpark which had better ventilation. This change also allowed migrant workers to leave the confines of their room, especially those who had been there for weeks. It was heart-wrenching to see some of them break down. The pandemic had robbed them of their livelihood and freedom.”



Screening of patients in the carpark of one of the Swab Isolation Facilities allowed migrant workers a reprieve from the isolation of their hotel rooms.

<sup>20</sup>Choo Xiu Hui, Senior Staff Nurse, Operating Theatres.

## May 2020: pulled from all sides

By May 2020, SGH Campus was sending teams out seven days a week to eight PBDs and two SIFs, in addition to running dedicated mobile mass swabbing and phlebotomy operations<sup>21</sup> at various locations.

“The virus is the real enemy”. This was the mantra that Ken Lee repeated often, sometimes aloud, sometimes silently, whenever the team was pulled in different directions. There were multiple reporting lines. Besides that, there was also a lot by way of instruction and advice from well-meaning seniors exercising domain expertise. Sometimes instructions were given directly to ground staff – Ken Lee and other team leads found themselves having to integrate it all and rationalising plans on a daily basis. To top things off, policies and processes were becoming increasingly complicated. The management of suspect and confirmed cases changed frequently, resulting in confusion on the ground.

This was exacerbated by the fact that multiple teams from different agencies [hospitals, Ministry of Manpower (MOM), Home Team<sup>22</sup>, SAF, and dormitory operators] had to coexist and coordinate their activities. Many helping hands could easily become many hampering hands if there was no alignment with the mission’s objectives. A great deal of time was spent working out new protocols and workflows, and communicating these to all the different entities at the dormitories. It was a daily challenge to bridge the desired policy goals of JTF(A) with the ground realities faced by the MMTs in the PBDs and SIFs.

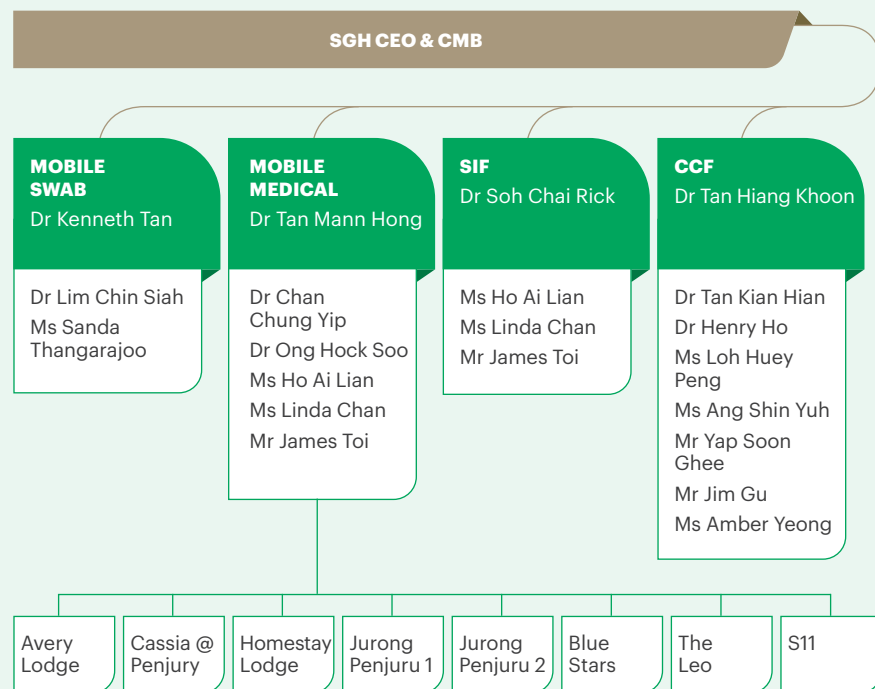
<sup>21</sup> To find out more about the phlebotomy operations, see Chapter 9.

<sup>22</sup> The Home Team refers to the agencies under the Ministry of Home Affairs, such as the Police, the Singapore Civil Defence Force etc.



## SGH CAMPUS EXTERNAL MEDICAL DEPLOYMENT COMMAND STRUCTURE

The SingHealth Medical Operations Cell would receive and process instructions from JTF(A). These would then be distributed across the different SingHealth teams. Within each institution, the respective leads had to then respond and deploy staff accordingly. The command structure for external operations in SGH as of early May 2020 is depicted in the chart below.



At the height of external operations, SGH Campus ran MMTs at eight PBDs, two SIFs and the Community Care Facility (CCF)<sup>23</sup> at Singapore Expo and D'Resort.

<sup>23</sup> CCFs were used to isolate those who tested positive for COVID-19 and were generally well but required monitoring. For more details on the deployment at the CCF at Singapore Expo, see Chapter 9.



Map showing the distribution of all dormitories, SIFs and CCF under SingHealth for the external COVID-19 operations in 2020.



SingHealth Medical Operations Cell members from SingHealth HQ, NNI, NHCS, SNEC, SGH and SAF at the Academia building on SGH Campus on 27 April 2020. This was the only time during the entire operations that the Ops cell met as a full group. Due to COVID-19 restrictions, operations were mostly run in a decentralised manner supplemented by online meetings and group discussions.

## The real risks

SGH Campus teams deployed for external operations faced austere, even harsh, conditions. Working in makeshift shelters such as tents, open spaces and parking lots, they alternately submitted to intense heat and torrential rain.

The fact that all this was a reality and not an exercise weighed heavily on the minds of the two doctor leads at S11@Punggol, Pua Ken Lee and Pang Hee Nee<sup>24</sup>. Medical staff normally worked in a controlled hospital environment, and many do not usually wear PPE. So working in full PPE in field conditions was a significant heat load. To acclimatise, Ken Lee himself went for runs with an N95 mask before deployment. Nurse Wayne Toh<sup>25</sup>, who was deployed in the MMT at S11 deadpanned, “I wasn’t trained to do this in nursing school.”

Recognising heat injury as a major risk for our frontline staff, the SingHealth Medical Operations Cell quickly arranged for fans, cooling units and refrigerators to be deployed at our medical posts.



The Medical Mobile Teams had to adapt to working under conditions very different from the hospital.

<sup>24</sup> Dr Pang Hee Nee, Senior Consultant, Department of Orthopaedic Surgery.

<sup>25</sup> Wayne Toh, Senior Staff Nurse, Radiology.

Strict infection control rules were also not easy to remember, especially if there was an emergency. Nurse Goh Rui Hao<sup>26</sup> was among the first wave of volunteers at Avery Lodge. When a worker had an epileptic attack at the dormitory dumpster, he rushed to his aid without his face shield. It was frightening because he was now potentially exposed to a person of unknown virological status.

I only realised that I was without my face shield when I saw the patient foaming at the mouth. Why was my vision so clear? Luckily, I had my N95 mask and hair net on.

As a Neurology nurse, I was trained to respond as fast as possible.

After this, I learnt to slow down, go through the steps to check my PPE first.

Goh Rui Hao, Senior Staff Nurse, Ward 74

SGH teams did not always have members who were fluent in the native language of the migrant workers, adding to the challenges of communicating through N95 masks and face shields. To better engage with the migrant workers, SGH worked with non-governmental organisations that supported migrant workers (such as HealthServe), and also brought in staff fluent in the workers’ native languages. The teams did their best to update the workers with information, and assist those who needed help.

<sup>26</sup> Goh Rui Hao, Senior Staff Nurse, Resident Nurse, Ward 74.

Beyond the risk of infection, the situation in the dormitories was also tense. The migrant workers were fearful of the unknown disease, and worried about the well-being of their families back home. They had come to Singapore to support their loved ones, but now their future was in limbo. Many saw friends coming down with COVID-19, evacuated to hospital and not heard from again. Rumours were rife and fake news rapidly spread via social media. Their movements in the dormitories were restricted, with uniformed personnel on site.

It was necessary to plan for public disorder, to keep the MMTs safe. SGH did this by working closely with the dormitory operators, as well as officers from the SAF, Police and MOM, all of which had also stationed staff in the dormitories.

The dormitories were a literal melting pot of tension, heat, misinformation and chaos – such was the workplace of the many deployed medical staff as Singapore weathered the darkest months of the pandemic.

### UNEXPECTED NIGHT ENTRY INTO THE HOT ZONE

About one or two weeks into our deployment at S11@Punggol, I received a call at 9:00pm from Lawrence, the dormitory manager. “The situation is tense. The workers insist on speaking to a doctor to understand what is going on.”

I was worried for my own safety, but I thought I could help. I was also fairly confident of Lawrence’s security arrangements. When I got there, about 40 to 50 workers were gathered in an open area within the security perimeter which the MMT was not allowed to cross. I passed through the gantry and walked up to them.

They needed reassurance, a listening ear, and wanted to know what would happen next. As I explained through a translator, their mood improved immediately. I realised this is what we should be doing – communicating regularly to let them know what was happening.

#### PANG HEE NEE

Senior Consultant,  
Department of Orthopaedic Surgery

*He was the medical lead for the dormitory.*

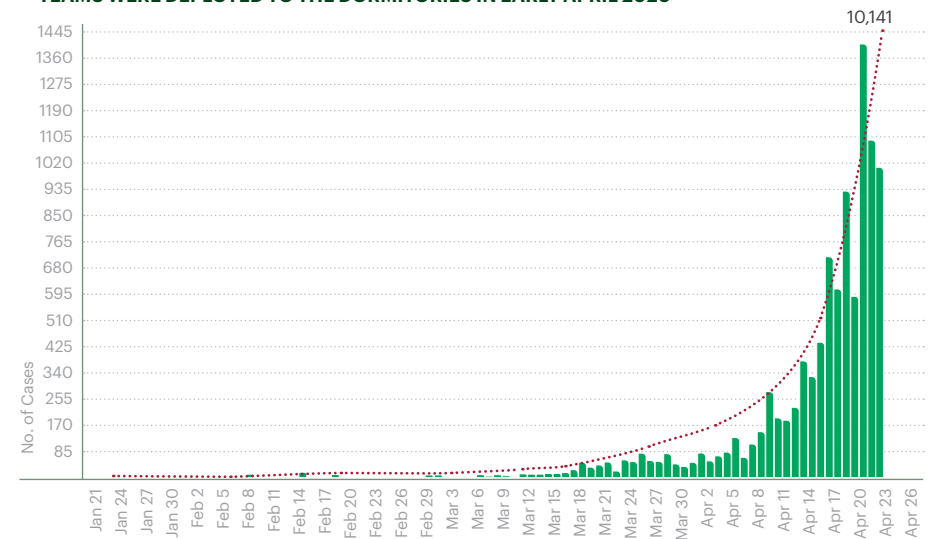
## Worries in the storm

**It was like a tsunami in slow motion.  
We were going to be overwhelmed,  
and there was nothing we could do  
to stop the onslaught.**

Lionel Cheng, Senior Consultant, Department of Diagnostic Radiology

SGH teams had no idea of the expected caseload in the dormitories. At a national level, we were still on the steep ascent of the epidemic curve. Within the first few days of deployment, it was clear that the odds were stacked against the medical operations. The number of COVID-19 cases in Singapore was rising inexorably each day. On 20 April 2020, barely a week after the deployment started, Singapore saw a record of 1,426 positive cases in a single day. Of these, 1,371 cases were from the migrant worker dormitories which were covered by SingHealth. The volcano had erupted, and the lava was flowing towards us, relentlessly. SGH could be overrun

**THE NATIONAL EPIDEMIOLOGY CURVE AT THE TIME WHEN THE MEDICAL TEAMS WERE DEPLOYED TO THE DORMITORIES IN EARLY APRIL 2020**



The line curve represents the cumulative cases, while the bar chart represents the daily cases.

Source: MOH. 22 April 2020 Daily Report on COVID-19. Available at: [https://www.moh.gov.sg/docs/librariesprovider5/2019-ncov/20200422\\_daily\\_report\\_on\\_covid-1901de85a8cb014d17868e15630c800a76.pdf](https://www.moh.gov.sg/docs/librariesprovider5/2019-ncov/20200422_daily_report_on_covid-1901de85a8cb014d17868e15630c800a76.pdf)

with COVID-19 cases in the coming weeks, flooding the ICUs<sup>27</sup>. The teams were deployed to protect the hospitals and form a first line of defence. But it looked like they were going to fail in their mission.

Physician Gan Wee Hoe<sup>28</sup> was seconded from SGH to lead the MOH Policy and Liaison Team at JTF(A) from early April 2020. “We were constantly caught between a rock and a hard place. COVID-19 cases in the dormitories were growing exponentially. However, hospitals could not decant patients fast enough to admit new infected workers. Every Emergency Department (ED) was swamped and newly-diagnosed workers took several days to be transferred to the EDs. Everyone was extremely concerned about the rapid build-up of cases in the dormitories. The urgent need to coordinate hospital transfer, ambulance assets, and plan for in-situ quarantine facilities in dormitory premises were among a million and one tasks we needed to do.”

The isolation facilities inside the dormitories ranged from rooms with a few beds to entire buildings for 1,000 people. Monitoring was a key challenge as the teams were not allowed to enter the workers’ living quarters. So, they depended on declarations of symptoms and clinical parameters



Operating seven days a week, the Mobile Medical Teams not only attended to COVID-19 patients, they also provided primary care to the dormitory residents.

<sup>27</sup> In the initial days of the outbreak, it was unclear how many cases would need ICU care. If 5% of cases required ICU care and the caseload averaged 1,000 new cases per day, there would be 50 new ICU cases per day. This would rapidly overwhelm national ICU capacity.

<sup>28</sup> Dr Gan Wee Hoe, Head and Senior Consultant, Department of Occupational and Environmental Medicine.

collected by volunteer laymen daily. Any patient needing review had to be brought to the medical team. There were no ward rounds. Everyone knew that in COVID-19, those who deteriorated did so in the second week of illness. Picking up those who were going to deteriorate was a matter of life and death.

In dormitories with a high prevalence of COVID-19, workers presenting with new respiratory tract symptoms were presumed positive without a swab, due to limited testing capacity. They were to be grouped together with previously swab-proven COVID-19 cases. However, such workers diagnosed without a swab were frightened of mixing with confirmed positive cases. Could the medical teams compel such patients to follow protocol based on epidemiological likelihood? Or should they send such newly symptomatic workers back to their dorm rooms and risk infecting other room-mates who were still asymptomatic? This was one of the many ethical dilemmas that the MMTs faced on a daily basis. Such cases had to be dealt with delicately, in consultation with the SingHealth Medical Operations Cell, taking dormitory-specific limitations into account. The solutions were often not ideal, but this was the best that could be done in the challenging circumstances.

Movement restrictions meant that the workers were cut-off from their usual healthcare providers. Over time, this meant that pre-existing chronic medical conditions had to be managed as well. Now, the MMTs also had to deal with problems like epilepsy, hypertension, endocrine disorders, and even malignancies, over and above acute respiratory illnesses. This greatly increased the demands on each medical team. Surgeon Wong Ting Hway<sup>29</sup> observed that the migrant workers required more than just medical attention. “They were seeing us because they had missed their hospital specialist appointments. Some had minor surgical wounds that had already healed and did not need more attention. Even with the reassurance, they were disappointed that they could not go for their specialist clinic appointments in the various hospitals. Clearly, cabin fever was getting to everyone.”

<sup>29</sup> Dr Wong Ting Hway, Senior Consultant, Department of General Surgery.

## FINDING THE SOURCE OF THE PROBLEM

During each consultation, I tried to exchange pleasantries for a few moments. It helped that I knew a few courtesy phrases in Bengali and Hindi. Workers from Andhra Pradesh would brighten when I mentioned that I had watched Baahubali, a movie from their state that had broken box office records across India. One said he had just re-watched it for, maybe the hundredth time, on his phone the day before. Another cracked a joke about the good-looking leads. Hopefully, my N95 mask did not slip when I laughed.

A patient came with a thick sheaf of laboratory results and discharge summaries from two Emergency Department visits, made within the last few weeks. Everything was normal. My colleague said he had seen him just a few days ago. His chief complaint was always of chest pain.

I was halfway through explaining to him that all the results were normal when I caught sight of a poster on the wall, with a phone number for a multilingual counselling hotline.

“Is it stress?”

He half-nodded. We persuaded him to call during the hotline hours.

He was back the following day. He said that when he called, he was asked to see us again. There was no referral note, and he could not tell us why.

I paused. My first thought was that the counsellor had trouble getting through to him; this was telephone counselling after all, where counsellors could not see their patients.

Then, it dawned on me – we had no excuse, he was right here, in front of us.

Mindful of the tendency to speak loudly with the N95 mask on, I lowered my voice, leaned closer so that he could hear me, and asked him – gently, I hoped – if he felt sad. His lips quivered and he looked down at his feet.

That was when he mumbled something about not being able to live anymore.

We called for an ambulance. He was sent to the nearest restructured hospital. I reached out to my friend Michael, the head of psychiatry at the hospital, hoping the worker was alright. “I am sure my team will take care of him, don’t worry!”

My friend explained he had not been to hospital for weeks. “When the pandemic began, I mobilised my department, rostered to cover one dormitory.”

“For the mental health needs?” I asked.

“Eh, we psychiatrists still remember our general medicine too!”

### WONG TING HWAY

Senior Consultant,  
Department of General Surgery

## How close is the light?

After the initial operation at Redhill, the swab teams were deployed every day, rain or shine<sup>30</sup>. Rapid reconnaissance was done for unfamiliar sites, and the teams adapted to different conditions, ranging from dormitories to hotels corridors and even parking lots. The unrelenting pace and constant changes in deployment plans were both physically and mentally draining for all involved.

We thought the swab operations at Redhill were a once-off event. But now, it was going on non-stop, with no end in sight.

Lim Chin Siah, Consultant, Department of Emergency Medicine



After the initial operation at Redhill, the Mobile Swab Teams were sent to other locations.

<sup>30</sup>To understand the role of the Mobile Swab Teams, see Chapter 9.

At the SIFs, migrant workers continued to stream in, busload after busload. The protocol stated that the workers would be moved out from these SIFs after their COVID-19 status was confirmed. But resource constraints resulted in many workers having extended stays in five-star hotels, isolated in single rooms<sup>31</sup> with hardly any contact with other people. Administrator Olivia Jakarias<sup>32</sup> felt for them. “Many of the workers were isolated in their five-star cages for extended periods, some for as long as 70 days. They were alone, without any physical interaction with the community. We witnessed many strong, grown men break down due to anxiety and frustration. They didn’t know what was happening, where they were being moved to next, what would happen to them, to their health, their job, their fate in Singapore.”

News reports<sup>33</sup> of the death of foreign workers with COVID-19 reverberated amongst the staff on the ground. As COVID-19 cases increased in the dormitories, a parallel mental health crisis was infiltrating stealthily into the world of the migrant workers. Quarantine and isolation measures were extended repeatedly with no end in sight. The tension was growing, and people were getting frustrated. The psychological strain was becoming evident to the medical teams, through medical consultations and the behaviour of the migrant workers.

<sup>31</sup> In their dormitories, workers lived communally, sometimes 16 to a room.

<sup>32</sup> Olivia Jakarias, Manager, Patient Liaison Service.

<sup>33</sup> Manas Sharma, Simon Scarr. (2020, May 22) How migrant worker outbreaks supercharged coronavirus spread in Singapore. Retrieved from <https://www.reuters.com/article/us-health-coronavirus-singapore-clusters-idUSKBN22Y29U>

Michael Yong. (2020, May 12) Man dies of heart attack caused by blood clot; confirmed to have COVID-19 after death. Retrieved from <https://www.channelnewsasia.com/news/singapore/covid-19-death-blood-clot-indian-national-12722510>

—●—  
*"We won't be stuck  
here forever,  
will we?"*  
—●—

**SGH STAFF  
MEMBER OF A MOBILE MEDICAL TEAM**

*Like the migrant workers, the staff too could not see the light  
at the end of the tunnel.*

## CHAPTER 9

# Service Beyond Our Walls

Until today, I never received a letter from the Ministry of Health telling us to cover the Expo. I never received an email. I never even received a WhatsApp message. It was all word of mouth. It was all based on trust.

**KENNETH KWEK**

Chief Executive Officer

*Words spoken at a webinar with staff on 27 November 2020, to describe how SGH swung into action*

## Mothership 2

In late April 2020, when dormitory and swab teams were in full swing, SGH Campus was tasked with another public health project – to operationalise a Community Care Facility (CCF)<sup>1</sup> at the Singapore Expo, Singapore’s largest convention and exhibition venue. This would create 3,200 beds to cater for COVID-19 cases who fulfilled the criteria determined by MOH. This would clearly be a formidable undertaking. The bed capacity alone was twice that of SGH’s. The team in charge had less than two weeks to make it happen.

Surgeon Tan Hiang Khoon<sup>2</sup>, already co-leading SGH’s dormitory operations, was handed the new challenge of spearheading SGH’s efforts at the latest real estate entrusted to us, to be dubbed CCF@Expo. The co-lead was cardiologist Chow Weien<sup>3</sup>, who was already part of the SingHealth Medical Operations Cell. As a sizeable proportion of SGH Campus resources had already been diverted to the dormitories, a new team was formed for the CCF@Expo assignment.

### TEAM LEADS OF CCF@EXPO

MEDICAL	NURSING	OPERATIONS	INNOVATION
Dr Tan Kian Hian Dr Henry Ho Dr Charles Goh Dr Toh Song Tar Dr Suriya Prakaash (CGH)	Ms Loh Huey Peng (SNEC) Mr Yap Soon Ghee Ms Ang Shin Yuh	Mr Jim Gu (SNEC)	Ms Lee Chen Ee (SingHealth)
INFECTION PREVENTION	ADMIN	PHARMACY	PATIENT EXPERIENCE & STAFF WELLNESS
Ms Lee Lai Chee	Mr Heng Yi Xiong	Ms Lee Soo Boon	Ms Tan Yee Pin (NCCS) Ms Yee Kaisin

All from SGH unless otherwise stated

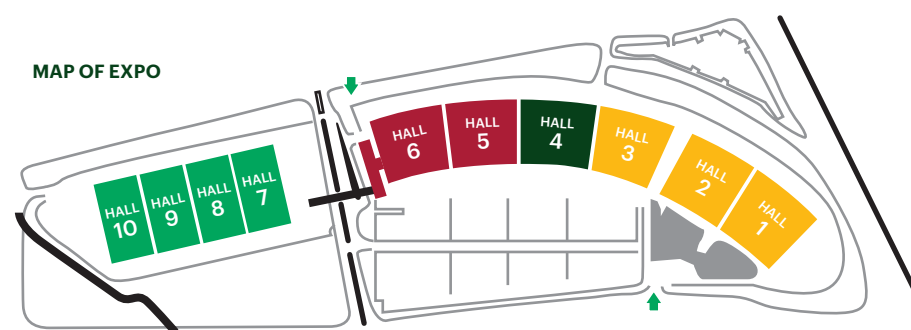
<sup>1</sup> Community Care Facility (CCF) was initially known as Community Isolation Facility (CIF).

<sup>2</sup> Dr Tan Hiang Khoon, Chairman, Division of Surgery and Surgical Oncology, SGH and NCCS.

<sup>3</sup> Dr Chow Weien, Consultant, Department of Cardiology, Changi General Hospital.

It was a tall order. In a short time, the team had to decide how to run the unfamiliar, repurposed facility safely, with limited staff from the already-stretched mothership. A visit to one of the halls operated by another healthcare group left a deep impression on Hiang Khoon. “It was a clean environment, but there was a very strong sense of isolation and danger. I remember thinking – if I felt that way, how much worse it must be for those who had to stay for weeks and weeks. And it was dangerous for the staff because they would be walking into a hall with hundreds of infectious COVID-19 patients. The patients clearly outnumbered staff hundred to one.”

SGH was assigned four halls (Halls 7 to 10), across the road from Halls 1 to 6, which were managed by other healthcare institutions (see figure below). The team had to organise the venue to make sure that staff would be safe. This included identifying entry and exit zones and designating areas for specific purposes, such as zones for staff to rest and for them to put on and take off their personal protective equipment (PPE). The modest manpower we would marshal meant that the blueprint used by institutions manning the other halls would not work for us.



Halls 7 to 10 were assigned to SGH, and were across the road and had a different configuration from the other halls in Singapore Expo. At the time SingHealth and SGH Campus were activated, Woodlands Health Campus was already running Halls 1 to 3, Parkway Shenton was running Hall 4 and SAF helmed Halls 5 and 6.



## Seeds of opportunity

Faced with these towering demands, the CCF@Expo team adopted innovations such as teleconsultation and telehealth monitoring. By leveraging technology and introducing innovative workflows, the team managed to run the gargantuan facility as a basic but efficient health depot. It was projected that the use of technology reduced staffing needs by a whopping 80% (from the initial projected requirements). CCF@Expo was able to function round the clock with 12 medical administrators, 26 doctors and 72 “angels”<sup>4</sup> on 12-hour shifts. With their inventive approach, they were able to publish their experience in an academic journal<sup>5</sup>.

Getting the four capacious halls running with hospital-like efficiency in under two weeks was no mean feat. The team partnered different parties such as Certis<sup>6</sup>, SingEx<sup>7</sup>, Resorts World<sup>8</sup> and other healthcare entities such as Woodlands Health, Parkway Shenton, Singapore Armed Forces (SAF) Medical Corps and SATA CommHealth to make the enterprise a success. Providing medical expertise was only a part (albeit a critical part) of the exercise, Weien remarked that the many different teams working together “was like a United Nations”.



Inside the Community Care Facility@Expo operated by SingHealth.

<sup>4</sup> “Angels” was a term used to refer to allied health professionals, nurses, as well as administrative and operations personnel who were part of the CCF@Expo team.

<sup>5</sup> Chia ML et al. Managing COVID-19 in a novel, rapidly deployable community isolation quarantine facility. *Ann Intern Med* 2021;174(2):247.

<sup>6</sup> Certis, the security organisation, was appointed to take care of security needs at the CCF@Expo for recovering COVID-19 patients.

<sup>7</sup> SingEx Venues is the operator for the Singapore Expo Convention & Exhibition Centre.

<sup>8</sup> Resorts World Sentosa provided pro bono services as the managing agent of the CCF@Expo. Over 2,000 staff volunteers provided non-medical care for the residents.



Staff at the Expo ensuring that colleagues were properly attired.

## Safety on unfamiliar ground

The staff from SGH Campus went into the project with a hospital mindset. But CCF@Expo was not a hospital. The team had to contextualise creatively continually. The usual hospital processes were rapidly adapted into practicable protocols. These protocols would enable safe care in what was essentially a makeshift medical facility. This was, in no small part, thanks to our Infection Prevention and Epidemiology (IPE) colleagues, who introduced practical steps to protect patients and staff from disease transmission. They also audited compliance with these processes. To ensure the safety of all, the SGH IPE team magnanimously extended their expertise to the staff of our non-healthcare partners.

Infection Prevention Nurse (IPN) Kamini<sup>9</sup>, who co-led a team of four, shared her experience outside hospital walls. “When we first conducted our audits, some staff were not so welcoming. They felt we were there to police them, or to catch them making a mistake. Hence, they just ignored us. So before starting the audit, I would introduce ourselves to the staff and explain that we were there not to find fault but to protect them from getting infected. Now, whenever I visit, staff are eager to ask me if they are doing things correctly. They understand that we are here to keep them safe.”

<sup>9</sup> Kamini Devi d/o Magesparan, Senior Staff Nurse, Infection Prevention and Epidemiology.

## Working as a team

Amidst the many unknowns of the pandemic, the leadership group had to engage the ground and be honest when giving updates about the evolving situation in the country and how it would impact the staff and patients at their new workplace. Effort was made to get daily feedback from the staff and implement feasible suggestions rapidly while maintaining morale. In addition, non-medical staff such as facilities and security personnel were managed as part of the team and were included in all discussions.

“Patients at the heart of all we do.” Nothing rang more true at the Expo than this oft-heard SingHealth adage. Our patients there were predominantly migrant workers from the dormitories. Many were stressed, worried and cut off from their usual social support networks. They had concerns about their

jobs, salaries, and about their health. By the time they arrived at CCF@Expo, they had undergone repeated extensions of quarantine and multiple rounds of testing. Some had endured several involuntary changes in residence, as efforts by the authorities to limit the spread of infection led to changes in plans, changes that translated into seismic shifts in their lives. The team provided them with medical care, assuring them that they would be well looked after. Pastoral care, needless to say, was also rendered.

### SINGHEALTH CCF@EXPO

<b>7,700</b>	patients
<b>3,200</b>	beds
<b>549</b>	staff mobilised at different times
<b>99</b>	days of operations (24 April to 31 July 2020)
<b>12</b>	days to reach full capacity (1 May to 12 May 2020)

## A DEFINING MOMENT

Within the first week of deployment, the nascent CCF@Expo team was put to the test. It was after 10:00pm and the day shift staff were heading home when busloads of patients arrived. It was clear that the lean night-shift team would be overwhelmed. A distress call was sent out and one by one, the staff from the day shift turned back, from the bus stops and MRT stations, to help manage the admissions.

A member of the CCF@Expo team shared. “I was amazed but happy – we were all from different departments and institutions, yet we pulled together.”

## Special Operations teams

In addition to the main medical teams managing the dormitories and CCF@Expo, the mobile swab team (MST) and mobile phlebotomy team (MPT)<sup>10</sup> also played crucial roles in the national response. These mobile teams were like “special operations” military teams that could be rapidly deployed where and when needed, usually at short notice. They contributed to the success of the work we had to do outside SGH.

Oftentimes, assignments for the following day were announced by Joint Task Force (Assurance) [JTF(A)]<sup>11</sup> late in the day, leaving little time for preparations. Be that as it may, the teams’ response was typically a robust, “Ok. We’ll go and recce the place now.” The teams adapted to any kind of environment that they were deployed to – from hotel lobbies, schools, corridors, and parking lots to construction sites. They were adept at responding to changing instructions, doing hasty reconnaissance

<sup>10</sup> Phlebotomy is the process of drawing blood from a patient for testing. The blood drawn by MPTs would undergo serology testing for COVID-19 antibodies. In those pre-vaccine days, the presence of such antibodies indicated a prior infection.

<sup>11</sup> The typical operations cycle for the swab operations would start with a WhatsApp group chat with JTF(A) discussing the potential sites for swabbing and then prioritising the most critical ones. The information would then cascade to the SingHealth Medical Operations cell and hospital level teams and finally, the swab teams.

of unfamiliar and sometimes desolate locations. Beyond these JTF(A) assigned work, MSTs also helped to swab residents and staff of nursing homes as well as essential contract staff on SGH Campus, as and when instructed. With a gung-ho attitude and without a fixed home, the MSTs repeatedly quenched the authorities' thirst to determine the extent to which the virus had penetrated the community, for they could swab a few hundred people within hours. A few members of the MSTs also trained swabbers recruited by the Health Promotion Board.

#### SGH CAMPUS MOBILE SWAB OPERATIONS

**111** days  
(12 April to 31 July 2020)

**162** deployments

**51,026** swabs performed

Nurses from various SingHealth institutions volunteered on their days off to be part of the MSTs. A thorough orientation followed by theory and practical training were given before deployment duties.

The SGH Campus MSTs continued deployments from their launch on 12 April 2020 till they finally stood down from full time operations on 31 July 2020, 111 days after that inaugural swabbing operation at Redhill.



The Mobile Swab Teams even trained staff of nursing homes to conduct swabs on their residents.

## Deploying Mobile Phlebotomy Teams

On 14 May 2020, there was a request for SGH to provide MPTs. While swabbing was meant to pick up hidden cases of COVID-19, phlebotomy operations would allow for blood sample collection to confirm or exclude a recent infection. Two teams comprising 20 members each were formed and deployed daily to multiple dormitories over eight weeks.

As the provider of phlebotomy services on SGH Campus, the SGH Department of Clinical Pathology was asked to spearhead this undertaking. Scientist Ng Wai Yoong<sup>12</sup> was initially anxious about setting up the teams. "Getting the staff numbers was challenging as many departments already had their COVID-19 commitments and it was going to be difficult to maintain large operationally ready teams over an unknown duration."

The phlebotomists were drawn mainly from SGH and from nurses of various SingHealth institutions. Together with volunteers among allied health colleagues and other staff from SGH, National Heart Centre Singapore (NHCS) and SingHealth headquarters, the MPTs were rapidly assembled within a matter of days. Medical administrator Tan Xiao Hui<sup>13</sup> described her first deployment to the migrant workers' dormitory, S11@Punggol. "It was so warm and humid. Our scrubs were soaked with perspiration beneath the PPE. Some of us had heat stress and had to stop for breaks. But the team's morale remained high and we cheered each other on."

Despite the discomfort and the unfamiliar environment, everyone was determined to get the work done.

<sup>12</sup> Dr Ng Wai Yoong, Assistant Director, Department of Clinical Pathology.

<sup>13</sup> Tan Xiao Hui, Senior Executive, Pathology Academic Clinical Programme.

One day at Blue Stars dormitory, it started to rain heavily and operations halted as the workers couldn't get to us. I then saw our colleagues pick up umbrellas to accompany the workers to the registration counters and phlebotomy stations so that the operations could continue. Their dedication to the mission left me in awe!

Beatrice Koh, Medical Laboratory Scientist, Department of Clinical Pathology

*She was one of the first to volunteer and organise the MPT operations.*

Each MPT made multiple visits to the dormitories. They had to coordinate with the dormitory operators and Forward Assurance and Support (FAST) teams<sup>14</sup>, which decided which workers needed the phlebotomy tests, and ensured that the queues were orderly. In 14 out of their 26 expeditions, they performed more than 1,000 venepunctures per day. SGH's

MPTs were subsequently called upon to assist the National University Health System at Sungei Tengah Lodge. This was the largest migrant worker dormitory in Singapore, housing over 23,000 workers.

#### SGH CAMPUS MOBILE PHLEBOTOMY OPERATIONS

<b>8</b>	weeks of operations (26 May 2020 to 16 July 2020)
<b>30</b>	phlebotomists and ancillary staff
<b>37</b>	outings
<b>26,542</b>	blood draws (range from 100 to 2,046 a day)

Before electronic registration was available, the swab samples and blood samples procured during these operations were manually catalogued and labelled by staff from SGH laboratories<sup>15</sup> and credit had to go to them for helping with the smooth running of the mobile swab and phlebotomy teams.

#### DRAWING BLOOD

(sung to the tune of "Planting Rice")

*Dressed in PPE not fun  
Donning face shield and face mask  
Dressed in gown and latex gloves  
You will run out and not last.*

*Carefully check right patient  
Steady gaze for juicy vein  
Gently give assurance  
Press to the end of task.*

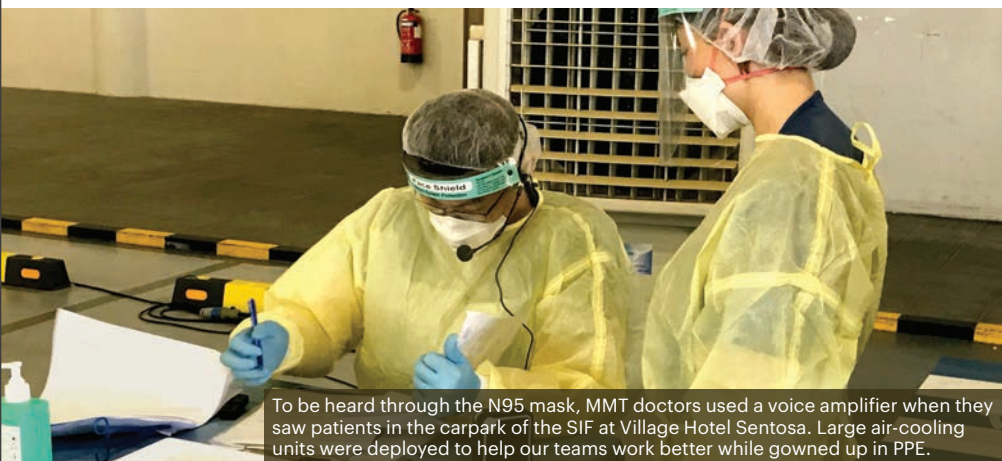
**LINDA CHAN**  
Deputy Director  
Nursing



The Mobile Phlebotomy Teams worked in unfamiliar conditions in various dormitories.

<sup>14</sup> FAST teams were composed of officers from the Singapore Police Force, Singapore Armed Forces, Ministry of Manpower and other government agencies. These teams were deployed in the migrant worker dormitories during this phase of the pandemic.

<sup>15</sup> The Molecular Pathology Laboratory ramped up capacity to run the PCRs on the swabs from the dormitories, while the Virology Laboratory performed the serology assays. For more details, see Chapter 3.



To be heard through the N95 mask, MMT doctors used a voice amplifier when they saw patients in the carpark of the SIF at Village Hotel Sentosa. Large air-cooling units were deployed to help our teams work better while gowned up in PPE.

## Thinking outside the (hospital) box

If necessity is the mother of invention, then a crisis must be the grandmother of innovation. Removed from a familiar working environment, our teams had to innovate to make things work. The concept of practising battlefield medicine was alien to most. The usual safety nets of multiple ward rounds, access to specialist referrals, support from allied health professionals and round-the-clock nursing care could not be expected – making it happen was also not reality. The provision of good clinical care at the external deployment sites therefore needed creativity and adaptability. There was a plethora of suggestions and initiatives – both bottom-up and top-down, and many were implemented swiftly.

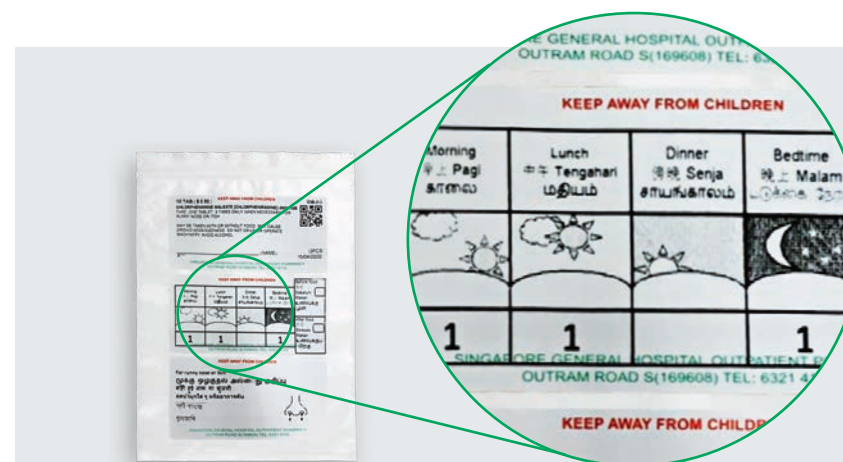
Simple adjustments to work processes helped to make things more manageable. The medical team at the Swab Isolation Facility (SIF)<sup>16</sup> at Village Hotel Sentosa was stationed in a basement parking lot. Communication was difficult as a result of echoes being magnified in the confined areas. The use of voice amplifiers similar to those adopted by tour guides made it easier for our staff to converse with patients.

<sup>16</sup> Swab Isolation Facilities were mostly hotels converted to isolation compounds for patients awaiting the results of a swab test.

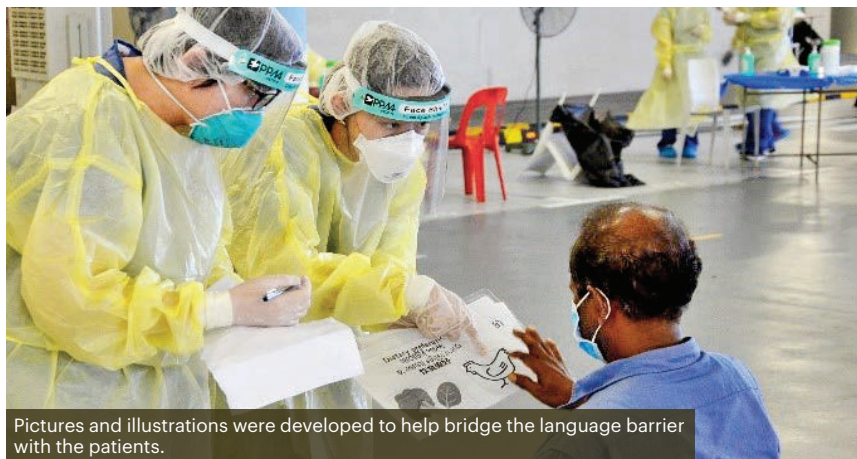
For dorm operations, initially we used disposable scrubs. The stock diminished rapidly and our supplier, a foreign company, could not keep up with the demand. We then replaced the tops with white T-shirts. Little did we realise that our staff at the dorms were sweating so much under their PPE that the white shirts would become translucent. We quickly replaced them with grey coloured shirts. This was different from our experience with SARS, which was fought within the hospital. For COVID-19, the battleground conditions varied with the environment.

James Toi Huat Chye, Chief Operating Officer (Ambulatory)

Most of our patients were foreign workers. To overcome the language barrier and prevent misunderstanding, pictures were often used to facilitate communication with them.



The SGH Pharmacy team used sun and moon labels on medicine packages to guide patients regarding the timing of their medications.



Pictures and illustrations were developed to help bridge the language barrier with the patients.

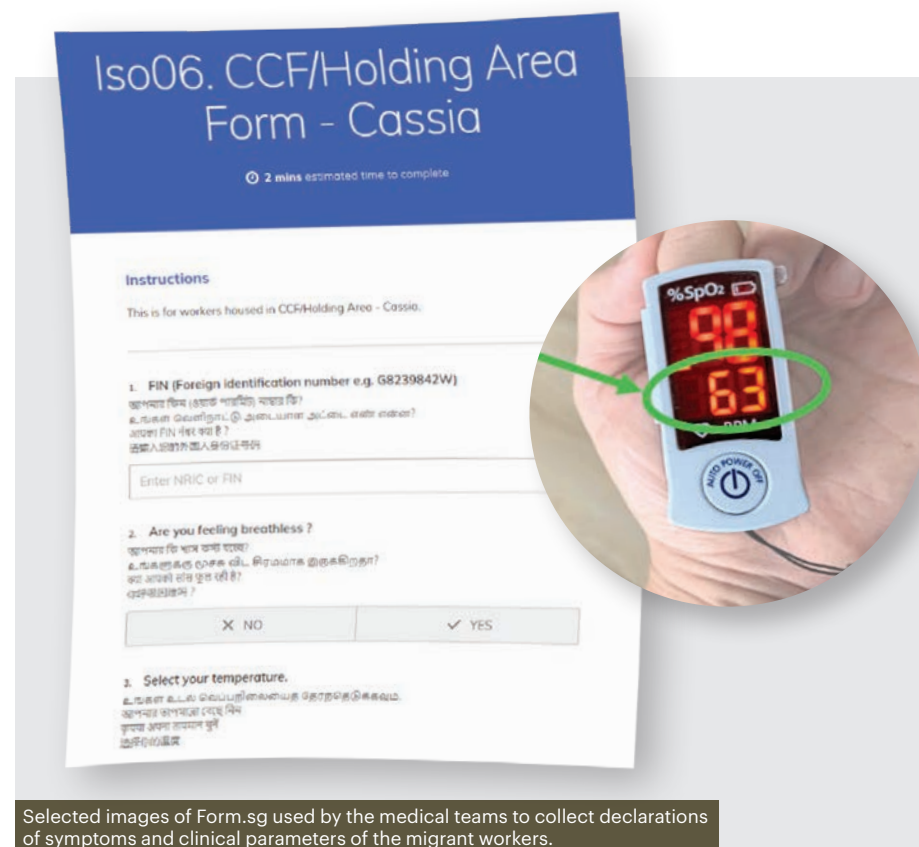
Strict safety rules prohibited medical teams from entering the dormitory buildings to do daily reviews of COVID-19 patients within their isolation rooms. However, the SGH team at Avery Lodge capitalised on the fact that these patients were housed on the ground floor and performed daily medical reviews through the windows. In this way, the team led by surgeon Goh Seo Kiat<sup>17</sup> was able to directly engage with the isolated patients, measure their clinical parameters with portable equipment, and render treatment.



The medical team at Avery Lodge performed ward rounds and measured clinical parameters for COVID-19 patients in isolation rooms through the window.

<sup>17</sup> Dr Goh Seo Kiat, Senior Consultant, Department of Orthopaedic Surgery.

At other dormitories, the patients under isolation or a room representative would report symptoms and clinical parameters using online forms on their personal phones. The data were then collated and abnormal results notified to the respective medical teams. These online forms in multiple languages were created by surgeon-in-training Justin Ker<sup>18</sup> and research fellow Khoo Yong Jie<sup>19</sup>. They even included images to show the migrant workers how to use the pulse oximeter. As each dormitory used different models of the device, these forms were further customised accordingly.



Selected images of Form.sg used by the medical teams to collect declarations of symptoms and clinical parameters of the migrant workers.

<sup>18</sup> Dr Justin Ker Ruixin, Senior Resident, SingHealth Neurosurgery Residency Programme.

<sup>19</sup> Khoo Yong Jie, Research Fellow, National Neuroscience Institute.

At CCF@Expo, the innovative use of virtual consultations, robots, self-declaration of clinical parameters by patients, and circadian lighting<sup>20</sup> enabled the huge facility to run smoothly. Surgeon Henry Ho<sup>21</sup> explained how the robots were used. “We used eight remote-controlled robots to reduce staff exposure as they cared for COVID-19 patients at CCF@Expo. Through the screen on the robot, our doctors, nurses and pharmacists were able to see the residents’ conditions to triage their needs. The remote access also enabled residents to have longer interactions with, and benefit from, the expertise of more caregivers, such as counsellors and even interpreters, who did not have to be physically at the Expo.



Migrant worker in CCF@Expo receiving instructions on inhaler techniques via video consultation with the pharmacist through a remote-controlled robot.

<sup>20</sup>Brightness levels of the hall lights were gradually adjusted at the start and end of each day, in line with the lightening and darkening sky. This mimicking of the changing light intensity each day was important for the many who had extended periods of isolation under artificial lighting, without exposure to sunrise and sunset. Circadian lighting is known to improve one's sense of well-being.

<sup>21</sup>Dr Henry Ho, Head and Senior Consultant, Department of Urology. He was also Research Lead for the CCF@Expo team.

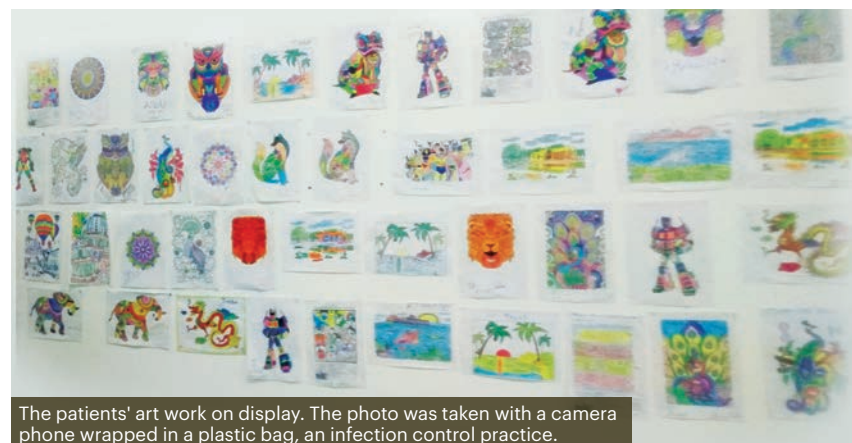
Our nurses used the remote-controlled device to walk about and look for residents who failed to submit regular vital sign readings, saving them long treks through the cavernous halls.

After clinic hours, the robots were parked within the halls to provide a night concierge service. Residents who were unwell could use them to activate the care team on-call outside the halls.”

## Beyond technology

Throughout the external operations, in the dormitories and isolation facilities, the healthcare team came up with ideas to ensure a human touch for the well-being of their charges.

At the CCF@Expo, the creation of an art gallery for patients to express themselves was very well received. Using donated art materials, many of the patients started expressing themselves creatively. Perhaps art helped them cope with the stress of prolonged confinement. It certainly gave their healthcare providers a glimpse of their perspectives.



The patients' art work on display. The photo was taken with a camera phone wrapped in a plastic bag, an infection control practice.

At that time – the nationwide partial lockdown called the Circuit Breaker was in effect – even visiting hair-dressers was proscribed. This was also true in the CCFs. Project Smart, which encouraged migrant workers to cut one another's hair, made a big difference to their morale. The ability to take care of personal grooming was a boost to self-esteem and had the unexpected effect of allowing people from different backgrounds and cultures to work together and help each other<sup>22</sup>.

Few patients had formal barber training, fewer could cut straight, but everyone gathered around and commented. Many friendships were broken or forged over the clippers that day. It was a hugely oversubscribed service as most were desperate for a trim. I have never seen so much glee and joy from getting a bad haircut between two complete strangers.

Jay Lim, Associate Consultant, Department of Urology



One of the staff in Hall 8 demonstrating her hairdressing skills. The residents' artistic creations adorned the wall of the art gallery at CCF@Expo.

<sup>22</sup>Such interactions between residents in the CCF@Expo halls were acceptable as they were all recovering or recovered COVID-19 patients.



Dr Jayant V Iyer from the HOT team reaching out to the workers in their native languages.

Recognising the need to reassure and provide the workers with accurate information, a dedicated Holistic response and Outreach Team (HOT) was formed to engage dormitory workers in their native languages. These doctors from SGH Campus and Sengkang General Hospital<sup>23</sup> went straight to work in many dorms, reaching out to workers and helping to alleviate their concerns. Their detailed reports of conditions in each dormitory and the concerns of the migrant workers were invaluable in refining the medical support plans.

Tan Hiang Khoo made it a priority to provide holistic care. "I realised the importance of taking care of them beyond just the clinical aspects. This weighed heavily on my mind. I reached out to psychologist Yee Pin<sup>24</sup>, and she brought in medical social workers (MSWs) Emily<sup>25</sup> and Hui Ping<sup>26</sup>, as well as speech therapist Kai Sin<sup>27</sup>, to look after both patient and staff well-being."

<sup>23</sup>Members of the HOT team included: Dr Jayant V Iyer, Glaucoma Department, SNEC; Dr Dennis Chia, Department of Emergency Medicine, SKH; Dr Susmita Roy Chowdhury, Department of Emergency Medicine, SGH; Dr Muntasir Mannan Choudhury, Department of Orthopaedic Surgery, SKH; Dr Hamid Rahmatullah bin Abd Razak, Department of Orthopaedic Surgery, SKH.

<sup>24</sup>Tan Yee Pin, Clinical Psychologist, National Cancer Centre Singapore.

<sup>25</sup>Emily Tan, Principal Medical Social Worker, Department of Medical Social Services.

<sup>26</sup>Peh Hui Ping, Medical Social Worker, Department of Medical Social Services.

<sup>27</sup>Yee Kai Sin, Speech Therapist, Department of Speech Therapy.



## WALKING IN ANOTHER'S SHOES

To provide psychological support for the migrant workers, I would try to put myself in their shoes. But I just couldn't wear their shoes, mainly because of the difference in culture. For example, when they told us they couldn't eat the food we provided, the initial response was, "Why are they complaining? We've already done so much for them." It turned out that the rice was giving them indigestion, as they were used to a different type of rice cooked differently. They were not being ungrateful at all. Once everyone adjusted, they were very appreciative.

There was a resident from India whose father was gravely ill at home. As the eldest son, he was required to be there for the last rites and funeral. Uncertain when he could leave, he was distraught. I entered the hall frequently to counsel him, and he would show me photos of his father. I felt helpless, unable to give him certainty in my answers. When his father passed away, I was told it was OK for men in their culture to cry. But I could not be sure, so it was difficult to assess if he was at any risk of self-harm. When he was finally able to leave, I saw him off at the Expo. From the airport, he sent me photos to tell me he had checked in, and again when he landed. It was just like what our family would do when they travelled. So over a matter of days, we had become family to them.

### EMILY TAN

Principal Medical Social Worker,  
Department of Medical Social Services

## Finding our footing

Working on the frontlines required our teams to work closely with non-medical teams, such as dormitory operators, Certis security officers, SAF personnel, MOM staff and various contractors. At the SIFs, cooperation and trust between the medical teams and hotel operators were crucial for the successful execution of operations.

Looking back, our teams deployed on these external duties thrived despite being outside their comfort zone, and many went beyond the call of duty. The close bonds and camaraderie between different professions and departments were in no small part enabled by a seamless and non-hierarchical work culture. Many went on to do multiple tours of duty in the dormitories. Some departments even adopted specific dormitories to which their staff were consistently deployed. This allowed important ground knowledge to be shared across generations of teams.

Surgeon Chan Chung Yip<sup>28</sup> described how the teams ensured continuity during a handover. "Alumni of various dorm teams were inducted into WhatsApp chat groups, where news from the media and happenings on site continued to be shared."

<sup>28</sup>Dr Chan Chung Yip, Head and Senior Consultant, Department of Hepato-pancreato-biliary and Transplant Surgery. He was one of the SGH leads for the mobile medical teams deployed to the dormitories.

## OPERATIONALLY READY MEDICAL SERVICEMEN

SGH benefited from a previously unrecognised asset - having amongst their staff former military regulars, especially those who had held leadership positions while serving in uniform.

### External COVID-19 operations by SingHealth

This core of ex-military medical regulars was able to tap into a rich and valuable network of military personnel, past and present. The network facilitated rapid information sharing and often helped the doctors overcome the red tape of official channels of communication. This enabled the medical operations to be carried out efficiently.

Besides ex-regulars, those with prior military medical experience, either as full time or operationally ready NSmen<sup>29</sup>, also found their past training helpful during the crisis. Among the many NSmen were examples such as ophthalmology trainee Charles Ong<sup>30</sup>, who was embedded in JTF(A) as the SingHealth liaison, and surgeon Puah Ken Lee<sup>31</sup>, who was instrumental in helping to manage the northern dormitories, including S11@Punggol.

Prior experience in working under austere conditions also proved advantageous. Emergency physician Lim Chin Siah<sup>32</sup> had previously served in Afghanistan under Mediciens Sans Frontiers (Doctors without borders) and was a natural pick for the post of leader of the SGH mobile swab teams. Work experience outside the confines of an academic hospital turned out to be a valuable resource for these prolonged, intense operations.

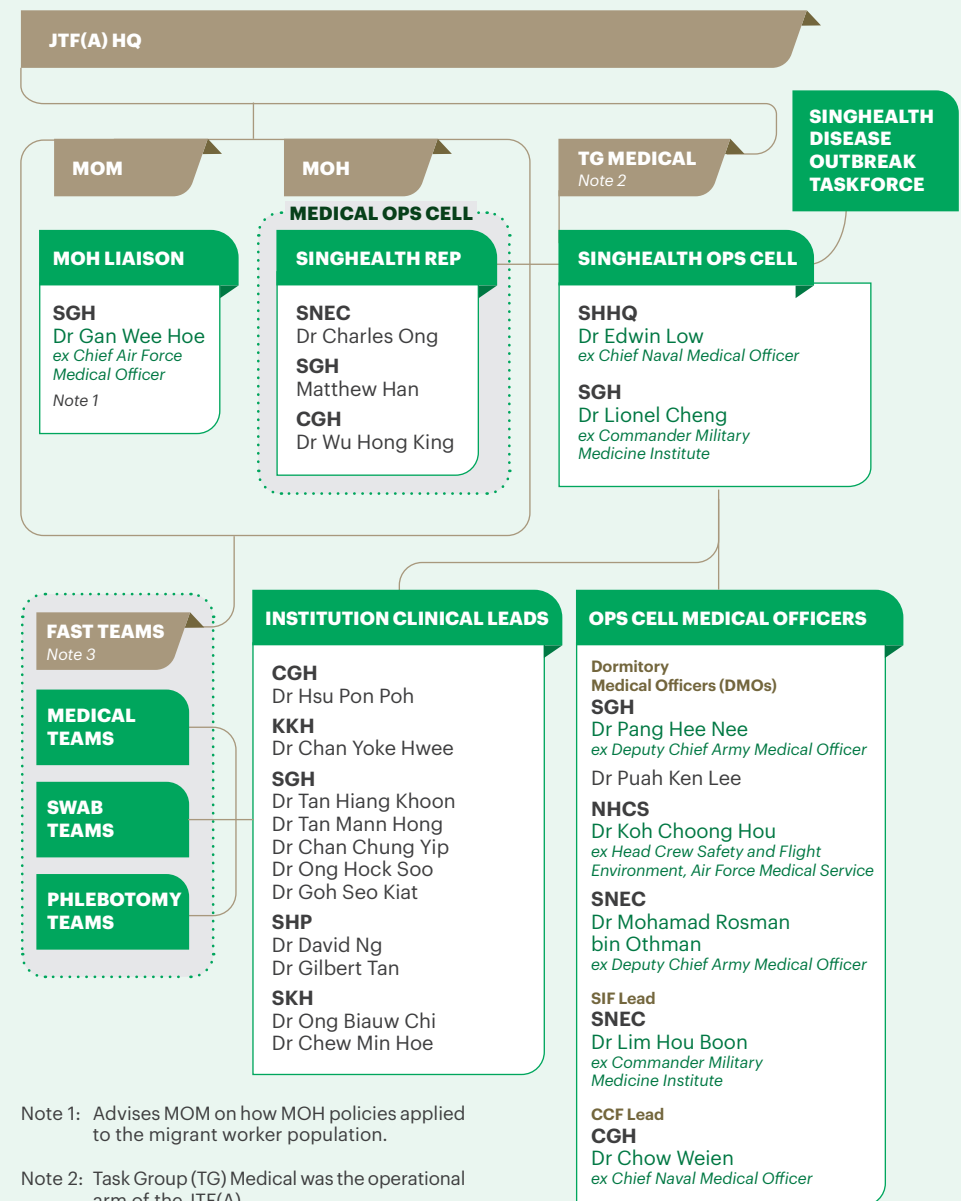
<sup>29</sup>All male Singaporeans are required to serve full time national service (NS) for two years, after which they return to normal civilian life as operationally-ready NSmen. During this time, they may be recalled for annual refresher training or operations, usually lasting up to two weeks. These annual sessions are referred to as in-camp training (ICT).

<sup>30</sup>Dr Charles Ong Jit Teng, Resident, SingHealth Ophthalmology Residency Programme.

<sup>31</sup>Dr Puah Ken Lee, Consultant, Department of Orthopaedic Surgery.

<sup>32</sup>Dr Lim Chin Siah, Consultant, Department of Emergency Medicine.

## SINGHEALTH EXTERNAL MEDICAL DEPLOYMENT COMMAND STRUCTURE



Note 1: Advises MOM on how MOH policies applied to the migrant worker population.

Note 2: Task Group (TG) Medical was the operational arm of the JTF(A).

Note 3: Formed by officers from SPF, SAF, MOM and other agencies.

## Light at the end of the tunnel

Towards the end of May 2020, the dormitory infections had stabilised but the numbers were still substantial. Many of us wondered how long we would need to be garrisoned at these sites. Hospital services were gradually picking up. The loss of manpower and skills from the hospital could compromise SGH's service commitments to its patients. The medical team at S11@Punggol, ground zero of the dormitory outbreak in Singapore, was busy simulating exit scenarios. Radiologist Lionel Cheng recalled the afternoon when the exit plan started to materialise. "Hee Nee, Ken Lee and I stood in front of the white board in the S11@Punggol dormitory operations room. On it were multiple boxes and arrows indicating various strategies to clear the dorm. How were we going to sort almost 10,000 workers in the dorm? Clusters of infections kept popping up and there was no way to keep ring-fencing in such crowded conditions. It then dawned upon us that if S11@Punggol was ground zero, it was likely that many workers would already be infected and have at least short-term immunity. Thus, if we could mount a massive serology operation, we could quickly identify a sizeable group which would be immune, who could potentially return to work."



Surgeons Puah Ken Lee (facing camera) and Pang Hee Nee (back to camera) formulating the exit strategy for the workers in the S11@Punggol dormitory.



Inaugural graduating cohort of S11@Punggol dormitory workers making their way to the Block for Recovered Workers on 20 May 2020, cheered on by healthcare team members lining the way.

Thanks to very detailed records kept by the dormitory operator at S11@Punggol, the team was able to determine exactly which blocks nested the initial wave of infections. However, due to the overwhelming numbers, not all cases were swab-positive – they had been presumed positive based on clinical and contact information. Combining serological and swab results permitted the dorm residents to be segregated into several groups – recovered, currently infected, COVID-19 status unknown/uncertain and COVID-19 naive (unexposed) groups. When this strategy was proposed and accepted, what followed was a massive serology and swabbing operation for the occupants of S11@Punggol, more than 10,000 of them. The management and disposition strategy could then be customised for each group.

Those who had recovered from previous infection and were swab-negative could return to their jobs. The assumption was that the number of recovered workers would be high, since this was the first dormitory to have an outbreak, and the infection would have had a longer time to spread. If a majority was proven to be recovered, there was potential to allow these workers to resume work as they would theoretically not be susceptible to a new infection.

This painstaking cycle of swabbing, serological testing and categorising was repeated for each sector of the dormitory. As we had suspected, a substantial proportion of the dormitory workers had already been infected, and would be able to go back to work. These workers subsequently graduated to a Block for Recovered Workers (BRW). The pioneer batch of graduates gladly marched to the BRW on 20 May 2020. A mini ceremony replete with music and healthcare team members cheering from a safe distance marked the event. This was the beginning of the end of a period of great uncertainty and distress for these workers.

It would take more than a month before this first batch of workers from S11@Punggol finally returned to work on 24 June 2020 – the delay was related in part to various administrative uncertainties. That morning, when the first group of workers exited the BRW and boarded transport to work, witnesses reported it as a truly emotional experience, as this day had seemed impossible a few months earlier.



The first batch of workers from S11@Punggol dormitory finally returning to work on the morning of 24 June 2020, almost three months after the dormitory was gazetted an isolation area on 5 April 2020.

The Assurance Care and Engagement (ACE) group was then formed by MOM as part of a national framework to provide a sustainable, long-term structure of dormitory management during this COVID-19 pandemic and beyond. As ACE took over the running of the external operations, our mobile medical teams were able to step down on 11 September 2020, marking 154 days of operations.

## “NEVER WAS SO MUCH OWED BY SO MANY TO SO FEW”

WINSTON CHURCHILL

During the circuit breaker, I grew accustomed to empty roads and abandoned construction sites. The noisy excavators at a major worksite near my home stood silent and still. One day, I spotted movement at the worksite and saw workers reporting for duty. I was suddenly overcome with emotion. Never in my wildest dreams would I imagine that seeing construction workers on site could bring tears to my eyes. The prolonged operations had taken a deep emotional toll on all of us. But life was slowly restarting. And all of us had played a role in making that happen.

The external operations turned out to be a golden opportunity for staff to form bonds across different institutions in SGH Campus and SingHealth. All of us were impressed by the immense depth of talent and commitment of those who stepped forward. We walked away with a deep respect for colleagues from different departments. It was as if SGH Campus had undergone some sort of orientation programme, akin to what university freshmen or military recruits experience. The friendships forged in adversity were priceless and will strengthen our unity in any future crisis.

We are forever indebted to the hundreds of silent saints who worked tirelessly at multiple levels, both at the frontline and back rooms, who will never be formally recognised for their immense efforts. All they have is the respect of colleagues – reciprocal nods of recognition during chance encounters along the corridors of SGH Campus. What sustains them is the satisfaction of having contributed to the nation in one of its darker moments. Each person, faithfully looking after his or her sphere of influence, multiplied thousands of times across SGH Campus and SingHealth, contributed to a formidable resource that Singapore could count upon.

### LIONEL CHENG

Senior Consultant,  
Department of Diagnostic Radiology

*Lionel was seconded from SGH to SingHealth and spent almost five months coordinating its combined external operations.*

At first of all, I would like to express my gratitude and sincere thanks to all of you for keeping the foreign workers healthy day and night during this COVID-19 infested period and it will continue till the last affected person.

I'm also a victim. I'm a Bangladeshi and working here in Singapore as a shipbuilder.

You've played a vital role in providing regular medical care, medicine, mask and sanitiser to keep us physically fit.

You've also arranged regular exercise, sports, arts and painting for our physical and mental development.

For this I would like to express my special thanks to the Doctors, Nurses and all health workers on duty here.

I thank the security on duty here and the cleaners who have always given us security and worked day and night to keep us clean.

You are the son of the Sun of the nation, the national Hero. Because you are the front line fighter against the COVID-19 virus.

I know that this loan of your service, care, sincerity and love will never be possible to repay but it will never be forgotten. This generosity of yours will be forever remembered by the Bangladeshis.

I believe that your generosity will one day be honored not only by Bangladesh but by the whole world.

Finally, I salute you all and salute on behalf of all Bangladeshis.

Thanks —

Thank you letter from a migrant worker at CCF@Expo.

## CHAPTER 10

# 2021 – The Battle Rages On

2021 began with the hope that vaccination would return us to normalcy. But the virus had its own plans, reinventing itself repeatedly to perpetuate its existence. The variants, christened according to the letters of the Greek alphabet, showed off their skills with devastating effect. Singapore's COVID-19 numbers rose relentlessly as the virus deftly dodged vaccine-induced immunity, while striking hard at the unvaccinated. To our disappointment, the virus penetrated the defences we had set up so successfully in 2020, and clusters were recognised in the hospital, among patients and staff. Measures were tightened, and N95 masks became de rigeur in our wards. 2021 was tough. Coming through it was enervating and bruising.



For a second year, staff worked under strict restrictions which included rules against interacting and socialising with colleagues. Meal times are lonely affairs as chatting without a mask has been shown to be a risk factor for transmission of the virus.

## Shots of hope

The year began on a promising note with the advent of the mRNA vaccines, which were seen by many as representing the light at the end of a long tunnel.

SGH kicked off its staff vaccination exercise on 8 January 2021, three weeks after the health authorities first approved the vaccine. Healthcare workers and other frontliners were given priority, and within two months, about 65% of the hospital's staff had received their first dose. By the end of 2021, more than 95% of staff were vaccinated, along with 80% of the population.



Prime Minister Lee Hsien Loong (top) received his first dose of the COVID-19 vaccine on 8 January 2021 at SGH. Operating Theatre Technician Soh Chee Peng (bottom left) and Radiographer Chang Yun Jun (bottom right) were among the first to be vaccinated.

## Safety first

When the in-house Vaccination Operations Group began working out the logistics of mounting a vaccination exercise for the staff, it emerged that the Pfizer BioNTech (BNT 162b2) vaccine came in multi-dose vials, meaning one vial was meant for five persons. The risk of overdose caused worries about patient safety. Infectious Diseases physician Limin Wijaya<sup>1</sup>, ever unflappable, quickly worked with her nurses to devise a series of steps that was not error-prone<sup>2</sup>. A single nurse acted as a preparation nurse, syringing out the five doses from each vial into five different syringes, and placing them into five different kidney dishes. The nurses who did the injections would use one syringe per patient and discard the entire kidney dish. There was no risk of giving a person more than the recommended dose.

To encourage vaccine uptake, the Ministry of Health (MOH) later allowed SGH to administer it to patients as well. This meant that the Vaccination Operations Group had to plan a programme for outpatient, and then, inpatient vaccination.



Label on each vial of vaccine indicated date and time the vial was opened for dilution, and when it was to be discarded.

To prevent mixing brands for first and second doses, MOH supplied only a single brand to each vaccination centre. Several months later, when it became apparent that some people were medically intolerant of the BNT162b2 vaccine, MOH gave SGH a small supply of a non-mRNA type (the Chinese Sinovac vaccine).

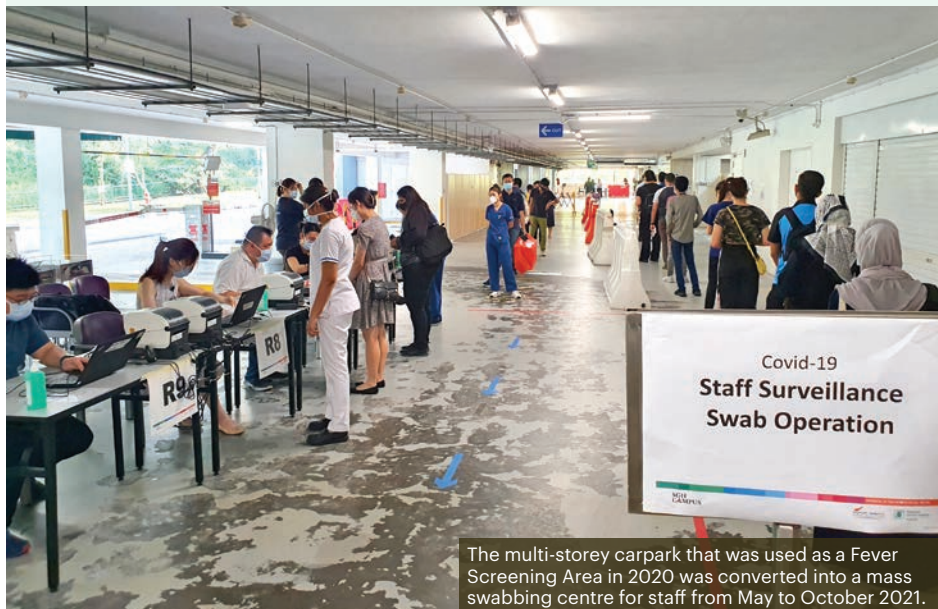
<sup>1</sup> Dr Limin Wijaya, Senior Consultant, Department of Infectious Diseases. She is also in charge of SGH's Travel and Vaccination Clinic.

<sup>2</sup> Up to the time of writing, no overdose has occurred in SGH, testimony to Limin's ironclad scheme.

## Testing times

In early May 2021, Singapore started to see a rise in cases. MOH mandated regular surveillance tests, called Rostered Routine Testing (RRT), for all healthcare workers. This was meant to detect infected but asymptomatic staff, thus preventing them from spreading the virus to their colleagues and patients.

SGH rolled out the operations on 8 May 2021, with doctors, nurses and allied health professionals volunteering to perform the swabs for polymerase chain reaction (PCR) testing. Staff were tested twice weekly. Six months and more than 136,000 PCR tests later, the operation wound down in October 2021 when SGH switched entirely to self-administered antigen rapid tests (ART) for staff RRT.



The multi-storey carpark that was used as a Fever Screening Area in 2020 was converted into a mass swabbing centre for staff from May to October 2021.

## Stressed

As the Delta variant rampaged through the community<sup>3</sup>, cases started to surface among staff. To prevent clusters from forming in the hospital, staff identified as close contacts of infected colleagues were quarantined. This principle had been applied in 2020 to great effect, but with staff of all stripes reporting positive results, the broadly-defined ring-fencing criteria created manpower problems. This problem was particularly thorny as it occurred at a time when the hospital was admitting more COVID-19 cases, many of whom were seriously ill.

### Loo Chian Min

to encourage doctors to help push your patients on trolleys rather than wait for porters - eg transfer from DEM, between wards, to OCH. Especially so if doctors are already accompanying, may not need a porter if doctors help push. Thanks everyone for helping.

When a cluster of cases involved porters, the large number hospitalised and quarantined almost brought this service to a standstill. Who would transport patients around the hospital for their various procedures? Loo Chian Min, Chairman, Division of Medicine, tapped on his own staff.



Facility engineer Krishna Muthu Barathi<sup>4</sup> was one of those who helped to cover porter duties, such as collecting medication for the wards from the pharmacy.

<sup>3</sup> Singapore's daily new cases topped 5,000 for the first time, with 5,324 cases recorded on 27 October 2021.

<sup>4</sup> Krishna Muthu Barathi, Facility Engineer, Department of Facilities Management & Engineering.



## Huddles

In October 2021, a new duty appeared on the monthly roster of the Department of Infectious Diseases (DID) – the COVID-19 huddle.

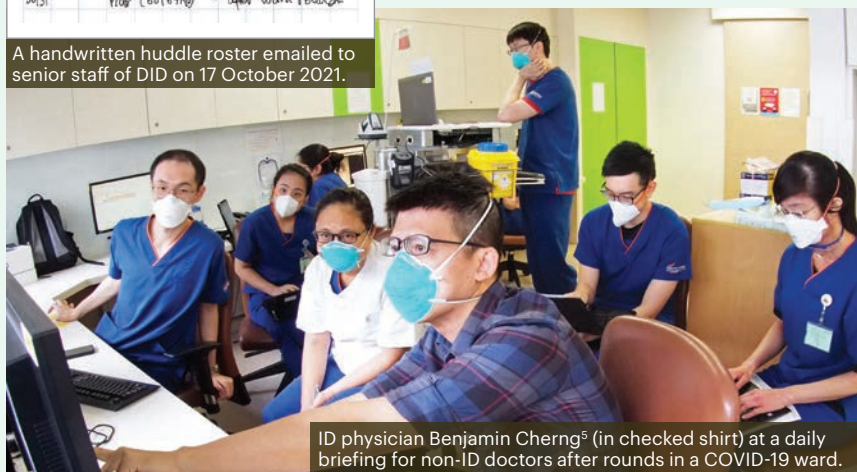
With hundreds of COVID-19 patients in the hospital, several wards were required to house them. Physicians from across the Division of Medicine were assigned to run these wards. Concerned that specialists outside the Infectious Diseases community would not be comfortable with the many facets of the care of COVID-19 patients, DID created the "huddle" roster. On top of their usual duties, ID physicians were put on a rota to huddle with individual teams, giving them a guiding hand on any aspect of COVID-19 management that they might have.

It was during this time that MOH received supplies of new drugs that could reduce the risk of progression to severe disease, if administered

early. An important part of the huddle was to ensure that patients at high risk of deterioration received these medications.

Date	Staff	Notes	Huddle
18-21	BB, GTA, LTB, GNA, GEB, GEB	Prov, Prov, LW, LW, TTT, TTT	
25-28	Prov, Prov, LW, LW, TTT, TTT		
29-31	Prov, Prov, LW, LW, TTT, TTT		
18/10	CH (G7A/B) / SB	on 23rd Oct.	
30/10	Prov (G7A/B)	after ward round	

A handwritten huddle roster emailed to senior staff of DID on 17 October 2021.



ID physician Benjamin Cherng<sup>5</sup> (in checked shirt) at a daily briefing for non-ID doctors after rounds in a COVID-19 ward.

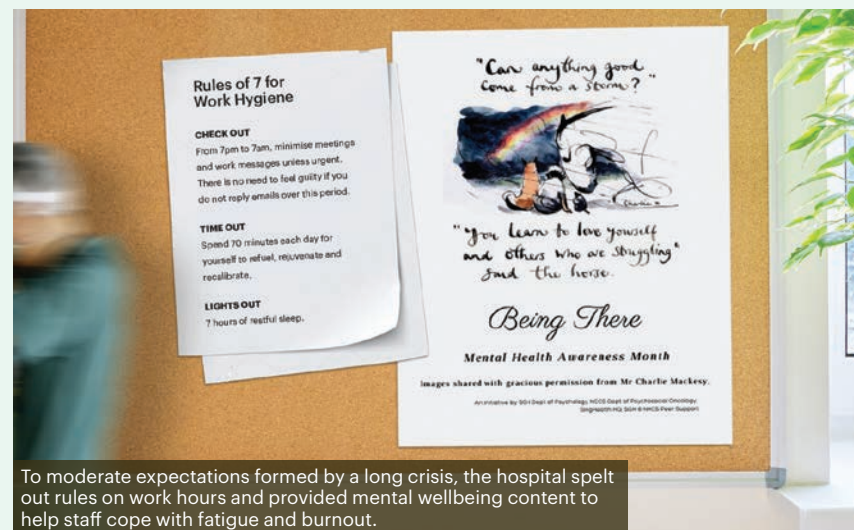
<sup>5</sup> Dr Benjamin Cherng, Senior Consultant, Department of Infectious Diseases.

## Rules of 7

As the pandemic dragged on, fatigue and burnout were obvious. Colleagues were noticed to be more easily irritated. The Delta variant was known to be more transmissible and staff infections, whether acquired in the community or at work, increased. It was not easy to remain extremely scrupulous in daily activities over such a long duration.

At the same time, as it became obvious that the vaccinated generally did not suffer adverse outcomes, there was a growing sense of restlessness everywhere with living under restrictions of all sorts<sup>6</sup>.

SGH management viewed the worsening fatigue with concern. They also understood the desire for a less rigidly organised work-life. A Staff Well-being Committee was formed, and staff were informed of the Rules of 7 – to check out from replying of messages from 7pm to 7am, time-out of 70 minutes each day and lights out with 7 hours of sleep.



<sup>6</sup> The Government, too, moved towards accepting that COVID-19 would become endemic. On 30 August 2021, MOH rolled out its Home Recovery Programme. Fully vaccinated persons who were not in vulnerable groups were allowed to self-isolate at home if they became positive for COVID-19. On 9 October 2021, the 1-2-3 protocol was introduced. Symptomatic persons were encouraged to see a doctor, and to self-isolate at home if hospitalisation was not considered necessary by the doctor. Self-isolation ended after 10 days.

## Home at last

Like many other countries, Singapore moved gingerly towards living with COVID-19. Nationwide, there was a gradual relaxation of rules. The opening of Vaccinated Travel Lanes (VTLs) allowed people to leave Singapore for a holiday without quarantine in either country. At the same time, relatives who were living abroad could also fly in to see their loved ones in Singapore without worrying about a long quarantine period before and after their visit.

On 19 October 2021, the MOH followed by allowing healthcare workers to travel overseas, paving the way for many of our staff to go home for the first time in two years.



Nurse Chan Yee Sin<sup>7</sup> seized on the VTL to hold her wedding at home in Malaysia in December 2021.

<sup>7</sup> Chan Yee Sin, Senior Staff Nurse, Ward 52C (Neuroscience Intensive Care Unit).

## Purpose with Passion

Epidemics have been part of the profession for centuries and have served as shining badges of honour instead of blemishes. It is the moment when societal value is most acutely appreciated, selflessness most needed and bravery most evident. This is the very basis of the profession: to value service beyond reward (and, if absolutely necessary, personal safety). The profession has guided society through the plague, the Spanish flu and SARS; and emerged every single time with distinction. Even when the science was lacking, with candour, concern and courage, the sick have been cared for, the healthy sheltered and the storms weathered. Epidemic response is in the DNA of healthcare work because it embodies why we entered the profession.

Anantham Devanand<sup>8</sup> Senior Consultant, Department of Respiratory and Critical Care Medicine

<sup>8</sup> Dr Anantham Devanand, Senior Consultant, Department of Respiratory and Critical Care Medicine. He is also the director of medical humanities in the Medicine Academic Clinical Programme. His quote is extracted from an essay published in the SingHealth Medical Humanities Newsletter Volume 1, Issue 3, February 2020.



## EPILOGUE

**IN LATE 2019**, we made the decision to tweak the structure of our SGH Disease Outbreak Taskforce to allow the domain experts to take the lead. It turned out to be a fortuitous move. Tan Thuan Tong as the Head of the Department of Infectious Diseases and Loo Chian Min as the Chairman of the Division of Medicine have very ably led our COVID-19 response.

With their domain expertise, they were able to sieve out relevant information and make sense of the volatile and complex situation. Senior management provided the support and resources for the Taskforce. Frequent and coherent communication through multiple channels was crucial in bringing everyone onto the same page for a coordinated and concerted effort. We were in this together!

With the mindset that no one had a monopoly on knowledge, a collective leadership structure with a flattened hierarchy was critical. Many people stepped up. They did not wait for instructions from the top but readily came up with ideas and carried out the solutions. The SGH can-do spirit shone through. The pandemic re-emphasized the core values of SGH.

Collaborations and teaming across various domains occurred naturally. SARS veterans and epidemic neophytes brought complementary insights and worked seamlessly together. I was initially stunned by how fast our people responded – repurposing space for fever screening, converting wards for isolation purposes, the list goes on. Each of those achievements, taken on their own, was amazing. The fact that they all happened in quick succession, with nary a decree from management, was simply phenomenal.

The pandemic showcased how resilient and innovative our people are. While we had invested in epidemic preparedness, and had in fact exercised several scenarios, the staff still had to come up with creative solutions in a very short time. We all adapted quickly to new ways of working. SGH is not the super-tanker that takes time to change its course. We proved ourselves surprisingly agile.

We have faced three waves of infections in the past two years, driven by different variants of the virus. Each time, we adjusted our approach without letting up on our efforts or vigilance. As this book goes to print, we are in the midst of the biggest community spread of COVID-19 infections thus far. More than 20,000 cases were reported on several days at the end of February 2022. In tandem with the high amount of cases, the number of patients in hospital has also surged.

As the nation’s flagship and largest hospital, SGH attends to everyone who turns up on our doorstep. Once again, we see amazing effort, making sure that no one is denied the care they need. Our people are fiercely protective of our unspoken compact with the nation – that SGH will always be here, to journey with Singapore through thick and thin.

We have learnt so much from this pandemic, but one lesson, to me, stands out – that it is paramount to take care of our people. We have always held fast to the mantra “Patients at the heart of all we do”. It is clear that our people must be at the heart of how we do that. Our people are our greatest asset. Take care of them and they will do amazing things – for the hospital, for our patients.

We can be proud of what we have done, and I am excited at what we will continue to achieve together.

**DR RUBAN POOPALALINGAM**  
Chairman of Medical Board



**PUBLISHED BY**

**Singapore General Hospital**  
Outram Road, Singapore 169608

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ISBN 978-981-18-4020-3

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**DESIGN AND PRODUCTION**

Redbean De Pte Ltd

Printed in Singapore, 2022



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*Singapore General Hospital  
would like to thank all  
staff and partners whose  
contributions helped make  
this book possible.*

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SINGAPORE GENERAL HOSPITAL

# PURPOSE WITH PASSION

## *Our COVID-19 Stories*

On 23 January 2020, Singapore General Hospital was thrust into a long and wearying battle when it confirmed the first case of the then emerging coronavirus infection on our shores. Steeled by lessons of the past, staff battled the uncertainties of the novel virus, even when they unexpectedly had to take the fight outside hospital walls. These are their stories as the crisis unfolded.



Singapore  
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