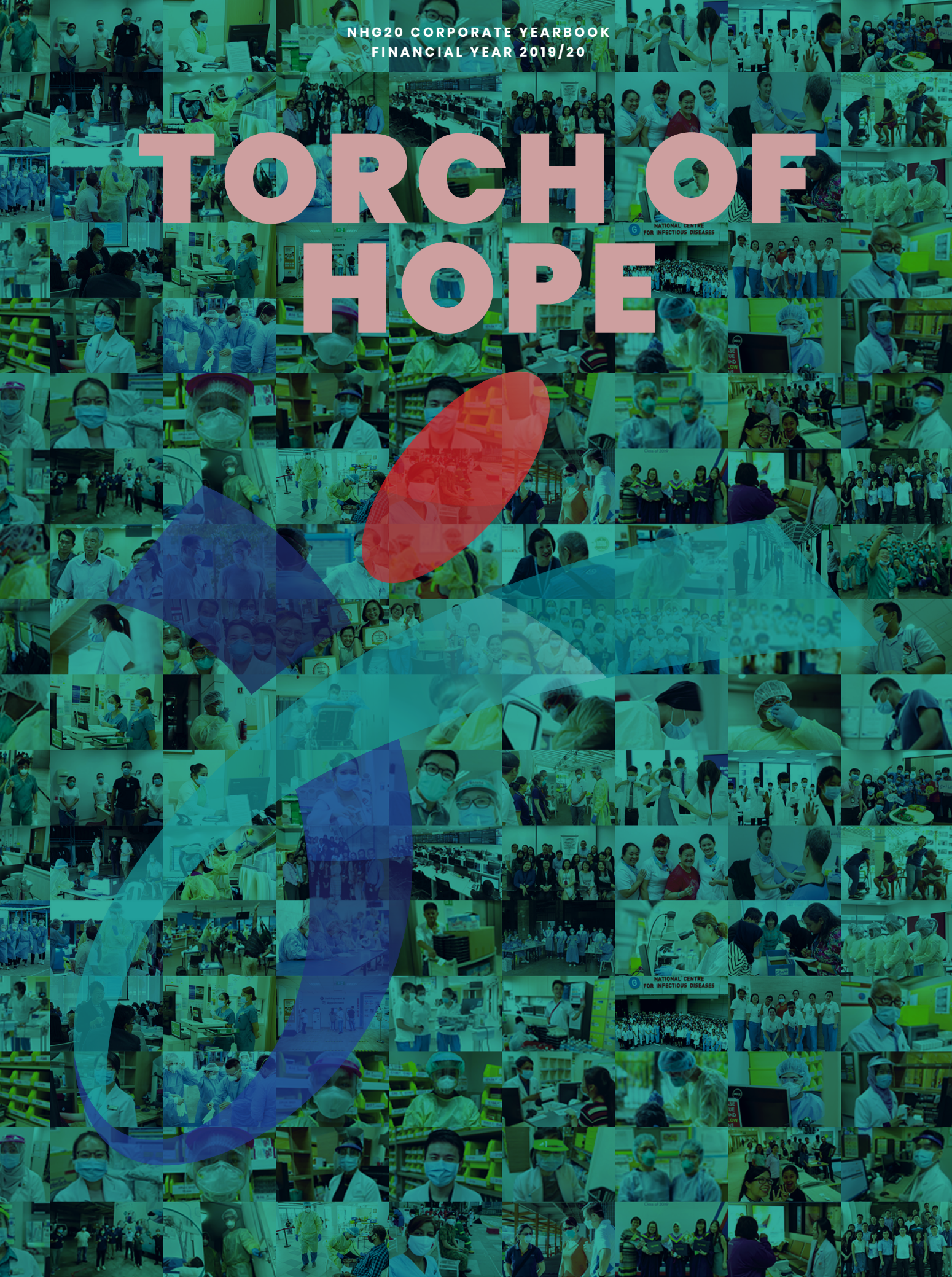


TORCH OF HOPE



NATIONAL CENTRE
FOR INFECTIOUS DISEASES

NATIONAL CENTRE
FOR INFECTIOUS DISEASES

BATTLING COVID-19

A TIMELINE OF NHG'S COVID-19 JOURNEY

JANUARY 2020

2 JAN
Screening for COVID-19 begins at TTSH Emergency Department's fever screening area

12 JAN
> Full genome of the SARS-CoV-2 virus is uploaded onto a public database
> Scientists from A*STAR and TTSH start on developing a diagnostic test kit

DECEMBER 2019

C3 System at TTSH/NCID fully operational for BAU operations

22 JAN
Singapore raises the DORSCON Level to Yellow
> NCID opens its first three outbreak wards
> KTPH Acute & Emergency Care Centre begins temperature screening



23 JAN
Singapore confirms its first COVID-19 case

28 JAN
NCID augments its manpower with staff from TTSH, and decants its BAU patients to TTSH

29 JAN
NCID opens its Screening Centre for COVID-19



24 JAN
NCID admits its first confirmed case (Singapore's second case)
> KTPH converts two wards into negative pressure isolation wards for COVID-19 cases

26 JAN
NCID opens its ICU and two contingency wards for suspect COVID-19 cases

FEBRUARY

6 FEB
TTSH and NCID commence enhanced pneumonia screening

7 FEB
Singapore raises the DORSCON level to Orange

12 MAR
PM Lee delivers his second address on the COVID-19 situation in Singapore

11 MAR
WHO declares the COVID-19 outbreak a pandemic

3 MAR
Singapore clears a new SARS-CoV-2 Assay for Clinical Use

MARCH

18 FEB
Singapore introduces the Unity Budget
> All six NHG Polyclinics begin conducting COVID-19 swab tests

14 FEB
TTSH and NCID pilot tests a face shield prototype that can potentially replace goggles



9 FEB
KTPH admits its first COVID-19 patient

8 FEB
Prime Minister Lee Hsien Loong delivers his first address on the COVID-19 situation in Singapore

16 MAR
NCID builds an expanded screening centre
> TTSH and NCID start the diversion of ambulances conveying suspected cases with Acute Respiratory Infection (ARI) to other hospitals

24 MAR
Singapore closes its and short-term visitation
> Opening of Communitas Facility - D Resor

26 MAR
Singapore Introduces the Resilience Budget

31 MAR
First COVID-19 case is found in a nursing home (Lee Ah Mooi Old Age Home)

APRIL

1 APR
Cases in Singapore reach 1,000
> NHG Group CEO Professor Philip Choo issued a message to commemorate NHG20 and update the NHG family on the COVID-19 situation



Produced by NHG Group Corporate Communications (GCC), issue 85 of Lifewise curates the united efforts of NHG in its fight against COVID-19 with the nation. Bumper issue 88 features a Circuit Breaker Journal, that comprises 'stillness photos', quotes and social media musings about this period of our lives.

THE END OF CIRCUIT BREAKER: JUNE 2020

1 JUN
End of Circuit Breaker
> NHG Group CEO Professor Philip Choo sends out a heartfelt message on the long journey ahead in the battle with COVID-19



9 JUN
Minister for Education Lawrence Wong delivers a national broadcast on 'Living with COVID-19'



17 JUN
Senior Minister and Coordinating Minister for Social Policies Tharman Shanmugaratnam delivers a national broadcast on 'A Stronger and More Cohesive Society'



2 JUN
Start of Phase 1 Re-opening

7 JUN
PM Lee delivers a national broadcast on 'Overcoming the Crisis of a Generation'



11 JUN
Senior Minister and Coordinating Minister for National Security Teo Chee Hean delivers a national broadcast on 'Resilience in a Changing External Environment'

14 JUN
Minister for Trade and Industry Chan Chun Sing delivers a national broadcast on 'Making a Living in a COVID-19 World'



19 JUN
Start of Phase 2 Re-opening

7 MAR
Peak of 740 PCR tests performed

20 MAR
TTSH transfers 20 COVID-19 patients to the first Community Isolation Hospital, Concord International Hospital



23 MAR
ICU Nurses from other NHG Institutions are deployed to TTSH to help
> NCID Screening Centre sees a peak of 520 patients



3 APR
PM Lee delivers his third address on the COVID-19 situation in Singapore, and announces the implementation of the Circuit Breaker that would run from 7 April to 4 May



4 APR
NHG volunteers busy sewing reusable cloth face masks, led by Dr Heng Bee Hoon, Lee So Chow, and the NHG Sewing Team

6 APR
Singapore introduces the Solidarity Budget

7 APR
Day 1 of Circuit Breaker Measures in Singapore
> KTPH welcomes its first batch of Singapore Airlines (SIA) cabin crew as Care Ambassadors




20 JUN
Deputy Prime Minister and Minister for Finance Heng Swee Keat delivers a national broadcast on 'Emerging Stronger Together'

10 JUL
Singaporeans vote at assigned polling stations, with safety measures strictly observed



EARLY JULY
NHG stands down its management of the four Swab Isolation Facilities (SIFs)



14 APR
NHG commences the setting up of medical posts at various migrant worker dormitories
> A large number of medical, nursing, and administration staff from NHGP are deployed to these medical posts, augmented by staff from other NHG Institutions
> Many radiographers from NHGD volunteered to work at Community Care Facilities




13 APR
Recruitment of recovered COVID-19 patients in Singapore to donate blood for plasma therapy treatment at NCID

10 APR
PM Lee delivers his fourth address on the COVID-19 situation in Singapore
> Opening of the Community Isolation Facility (CIF) at Singapore Expo
> TTSH transfers the first 19 patients from NCID to Singapore Expo
> Launch of the GCC NHG TORCH OF HOPE video




8 APR
YCH begins converting wards to house COVID-19 patients

9 APR
TTSH begins preparing additional wards on Levels 7 and 11, as well as ICU beds for COVID-19 patients who require acute care



23 JUL
NHG hands over medical support management of 14 migrant worker dormitories to Fullerton Health and SATA CommHealth



AUGUST

55

9 AUG
Singapore celebrates its 55th birthday, which includes a tribute to all frontline and essential workers



21 APR
PM Lee delivers his fifth address on the COVID-19 situation in Singapore, and announces the extension of the Circuit Breaker to 1 June

23 APR
NHGP's Pharmacy Services Centre Central Fill Pharmacy team and volunteers ensure that home deliveries for patients are fulfilled on time

27 APR
21,000 migrant workers living in dormitories test for COVID-19

28 APR
MDH announces a comprehensive medical strategy for COVID-19

29 APR
Singapore crosses the 15,000 mark of COVID-19 cases
> SIA staff commence training as Care Ambassadors in TTSH

30 APR
PM Lee delivers his May Day Rally Speech





MAY

1 MAY
National tally surpasses 17,000 cases

5 MAY
A message from Madam Kay Kuok, Chairman, NHG saluting healthcare heroes

6 MAY
Singapore crosses the 20,000 mark
> NHG steps up coordinated efforts with the nation to contain COVID-19

15 MAY
> A new daily high of 1,275 patients are discharged
> National tally stands at 26,891

22 MAY
Singapore crosses the 30,000 mark
> Allied Health Professionals conducting simple exercises for migrant workers





17 AUG
DPM Heng delivers a Ministerial Statement on Continued Support for Workers and Jobs



26 MAY
Singapore introduces the Fortitude Budget

27 MAY
TTSH Lab begins serology testing for COVID-19





Adding years of healthy life



CON

WE ARE NHG

The National Healthcare Group (NHG) is a leader in public healthcare in Singapore, recognised at home and abroad for the quality of its medical expertise and facilities. Care is provided through an integrated network of six primary care polyclinics, acute care and tertiary hospitals, national specialty centres and business divisions. Together they bring a rich legacy of medical expertise to our philosophy of integrated patient-centred care.

NHG's vision is "Adding Years of Healthy Life". This vision goes beyond merely healing the sick to the more difficult and infinitely more rewarding task of preventing illness and preserving health and quality of life. With some 20,000 staff, NHG aims to provide care that is patient-centric, accessible, seamless, comprehensive, appropriate and cost-effective.

As the Regional Health System (RHS) for Central Singapore, it is vital for NHG to partner and collaborate with stakeholders, community advisors, and voluntary welfare organisations. Together with our patients, their families and caregivers, we aim to deliver integrated healthcare services and programmes that help in *Adding Years of Healthy Life* to all concerned.

OUR VISION

ADDING YEARS OF HEALTHY LIFE

OUR CORE VALUES

PEOPLE-CENTREDNESS

We value diversity, respect each other and encourage joy in work.

INTEGRITY

We commit ourselves to the highest standards of ethical conduct.

COMPASSION

We care with love, humility and empathy.

STEWARDSHIP

We are responsible for the care of our people, patients and population.



NHG BOARD AND SENIOR MANAGEMENT

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Lessons learnt from SARS and investments in science, research, and technology have provided game-changers for Singapore.



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In Singapore's battle to overcome COVID-19, NHG mounted a cluster-wide coordination effort to meet the scale, complexity and urgency of the crisis.

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Singapore is working with groups worldwide to ensure timely access to successful drugs and vaccines.

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CORPORATE YEARBOOK
FINANCIAL YEAR 2019/20



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Unprecedented speed seen in development efforts to produce first effective and safe vaccine.

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As the country comes to grips with a new normal, NHG is involved in a collaborative effort to help migrant workers recover from the coronavirus so that they can re-enter the workforce.

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The Tan Tock Seng Hospital outbreak management framework is a continual work in progress; building upon lessons learnt from every outbreak.

72 NDP2020: Singapore Pays Tribute to Frontline and Essential Workers

NHG Senior Management and Staff were recognised in various segments, including the National Anthem and Pledge Moment, Mobile Column, Roar of Unity and the NDP Parade at the Padang.



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NHG recognises the urgent need to radically transform healthcare delivery through growing investment in upstream action.

93 Clinical Care

With Singapore's ageing population and complex healthcare needs, NHG is redesigning our processes to integrate health and social care services for our patients and the population we serve.

111 Research, Innovation & Technology

NHG leverages on the collective strength and intelligence of both humans and machines, to enhance clinical care delivery systems, improve the quality and safety of care, as well as promote patient empowerment.

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Education is a critical pillar of NHG, and we are committed to building a resilient, future-ready and versatile workforce capable of operating across various care settings.

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The NHG Family celebrates its 20th anniversary.

ABOUT OUR INSTITUTIONS

ABOUT THE COVER

The cover pays tribute to the NHG Family's collective efforts and commitment to combat the COVID-19 pandemic. We will continue to raise the Torch of Hope and Give Thanks even in the face of challenging times ahead.

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NHG BOARD & SENIOR MANAGEMENT

“ By embracing collective leadership across all roles, and at every level, and by practising our values of People-Centredness, Integrity, Compassion, and Stewardship, we will not only meet the COVID-19 challenge but would emerge stronger. Together – and now more than ever – let us strive on to *Add Years of Healthy Life* for our patients, the population, and the nation.”

MADAM KAY KUOK
CHAIRMAN, NHG





CHAIRMAN'S MESSAGE

2020 has been a challenging year – not just for the National Healthcare Group (NHG) and Singapore, but for the world. The COVID-19 pandemic has tested healthcare systems, political resolve, and people's resilience on a global scale, in the year since its emergence. As we find ourselves in a better situation in Phase 2 of the nation's re-opening, I would like to take the opportunity to thank the NHG Family and our partners in healthcare and the community for rallying together,



along with the people of Singapore, to lower the number of our coronavirus cases. Thus far, we have witnessed acts of great courage, strength, and solidarity from those on the frontlines, as well as others behind the scenes. Both clinical and non-clinical staff across all NHG Institutions have risen to the occasion on multiple fronts. I am immensely grateful for your commitment to NHG, the healthcare profession, and our population.

It has been a mammoth feat to get the COVID-19 pandemic under control in Singapore, and NHG has played its part in the nationwide effort admirably. I am proud that the National Centre for Infectious Diseases (NCID) – which only officially opened in September last year – with the steady support of Tan Tock Seng Hospital (TTSH), has been the epicentre

of Singapore’s fight against SARS-CoV-2, working relentlessly to care for the patients and keep our mortality rates low. Similarly, in the North, Yishun Health has commendably been managing a sizeable share of Singapore’s migrant worker population afflicted by this coronavirus.



MADAM KAY KUOK
CHAIRMAN
National Healthcare Group





Furthermore, teams from both TTSH and Khoo Teck Puat Hospital (KTPH) are working very hard to support those most vulnerable to the virus – the elderly – by training staff from nursing homes and homecare providers on swab testing, handling specimens, and infection control, including how to don and doff Personal Protective Equipment (PPE).

NHG's pivotal role in managing the pandemic has extended beyond the walls of our hospitals and clinics into the wider community. Staff from across the NHG Family – including Woodlands Health Campus (WHC), National Healthcare Group Polyclinics (NHGP), the Institute of Mental

“NHG’s pivotal role in managing the pandemic has extended beyond the walls of our hospitals and clinics into the wider community.”

MADAM KAY KUOK
CHAIRMAN, NHG

Health (IMH), the National Skin Centre (NSC), NHG Pharmacy (NHGPh), and NHG Diagnostics (NHGD) – have collectively set up and managed Community Care Facilities (CCFs) for patients with mild symptoms, as well as Swab Isolation Facilities (SIFs) for those awaiting their swab test results. They have also provided clinical and administrative expertise at the Medical Posts in the Purpose-Built Dormitories (PBDs), hotels, and resorts, and doubled up as mass swabbing teams around the island. Their tireless work in the pursuit of migrant workers' health and well-being, and in the service of lowering the risk of community transmission in the country, is to be appreciated and applauded.

Our fight against SARS-CoV-2 has not been limited to the frontlines of testing, tracing, and treating. We are also driving several research initiatives to understand the characteristics and behaviour of

TOP Prime Minister Lee Hsien Loong with Prof Leo Yee Sin, Executive Director, NCID, during a visit to NCID in January 2020.

LEFT Dr Benjamin Seet, Deputy Group CEO (Education & Research), NHG, at a migrant worker dormitory.



the novel virus, to develop effective therapeutics, and help in discovering a vaccine. In fact, as early as January 2020, a COVID-19 Research Workgroup was established, spearheaded by NCID, to produce studies relevant to understanding COVID-19 transmission in Singapore. Chaired by NCID's Executive Director Professor Leo Yee Sin, and advised by the Ministry of Health's (MOH) Chief Health Scientist Professor Tan Chorh Chuan, the Workgroup comprises members from public healthcare institutions, MOH, DSO National Laboratories, Duke-NUS Medical School, and the Agency for Science, Technology and Research (A*STAR). One example of the Workgroup's indispensable efforts to demystify COVID-19 was the launch of seroepidemiological studies in April 2020 to determine the proportion of the population, including those who were asymptomatic and frontline healthcare workers, infected by the disease. Seroepidemiology – the use of antibody-based tests to identify which population segments have been exposed to an infectious disease, and in what proportion – is a well-established tool for managing infectious diseases. Besides studying the virus' transmission, NCID, together with its research partners across Singapore, have also made remarkable inroads in understanding its genome and how it manifests in patients – knowledge that would be critical in developing both treatments and vaccines. In August 2020, researchers from NCID, A*STAR, and Duke-NUS Medical School announced

the discovery of a genetic variant of the SARS-CoV-2 virus that causes less severe symptoms in patients – findings that were published in the international scientific journal *The Lancet*. NCID and A*STAR also jointly published another study on their discovery of specific sites on the virus that our antibodies bind to – findings which have implications for diagnostics, therapeutics, and vaccine development. Eventually, this critical information would add up to help us break down the nature of the virus – and perhaps, ultimately, defeat it.

These efforts by the NHG Family to mitigate the impact of the pandemic have not gone unrecognised by the people of Singapore. It has been heartening to hear the many stories of acts of appreciation by the public, in the form of delivering

BELOW (TOP) Prof Eugene Fidelis Soh, CEO, TTSH & Central Health and A/Prof Chin Jing-Jih, Chairman Medical Board, TTSH & Central Health.

BOTTOM Dr Wong Kirk Chuan, COO (Population Health), NHG & COO, WHC, with frontline staff at the Singapore EXPO.



food, care packages, and gifts of medical equipment, for our first-responders. These acts are testament to how far Singapore has grown as a society. I think back to the significantly different public reaction to healthcare workers during the height of the SARS pandemic – and I am grateful for this positive change. Although I am certain that every member of the NHG Family is, above all, motivated by an intrinsic calling to care for the health of our population, I am glad that their dedication during this difficult time has been recognised.

I would like to acknowledge those within NHG, as well as our community partners, who have shouldered the task of continuing to provide healthcare services beyond infectious disease management – particularly for our patients with chronic illnesses. I thank you for supporting our patients, even as our resources are stretched, and for adapting to the 'new normal', through the accelerated adoption of telemedicine and other digital health initiatives. While developing new protocols and revising existing workflows to address changes wrought by the pandemic have been demanding, you have done a fine job in ensuring our patients receive timely, reliable, and quality care.

MARKING MILESTONES IN THE MIDDLE OF A PANDEMIC

Although the COVID-19 pandemic has been the primary focus of all our care efforts, we must take a moment to celebrate the NHG Family's many noteworthy accomplishments in the past year. On 1 April 2020, NHG marked 20 years in public healthcare. As we could not come together physically to commemorate this milestone, we decided to pay tribute to our staff for diligently serving the healthcare needs of the Central Region of Singapore by recording an original song: 'Torch of Hope'. Co-produced by NHG Group Corporate Communications and composer, Clement Chow, two editions of the song were created – a studio version and a staff edition – to recognise staff across all NHG Institutions for their immeasurable contributions to the public healthcare ecosystem in Singapore.

Within the NHG Family, several of our member Institutions, Business Units, and partners are also marking their respective anniversaries in 2020. KTPH, our anchor hospital in the North, celebrates 10 years of patient care. Since joining the NHG



Family following the public healthcare re-clustering exercise in 2017, KTPH has enriched our mission to provide accessible, affordable, and reliable care for our patients, and has significantly augmented our healthcare transformation efforts in the shift towards population health. Joining KTPH at the 10-year mark are NHG Group Education and the Lee Kong Chian School of Medicine (LKCMedicine) – both responsible for nurturing the healthcare professionals of tomorrow. Since its modest beginnings with the medical residency programme, NHG Group Education has gone from strength to strength to oversee the teaching, training, and professional development of Medical, Nursing, Pharmacy, and Allied Health Professionals, as well as play a key role in health professions and education research. I wish them many more years of success in their laudable endeavours.

TOP NHG Senior Management walking the ground at KTPH.

BELOW Prof Philip Choo, Group CEO, NHG, A/Prof Chong Phui-Nah, CEO, NHGP & Primary Care and Dr Mok Ying Jang, Deputy COO, NHGP at the migrant worker dormitories.



LKCmedicine's 10th anniversary coincided with the school's first virtual Convocation ceremony for the Class of 2020. In a series of pre-recorded messages and video compilations, Deputy Prime Minister, Mr Heng Swee Keat, and leadership from Nanyang Technological University, Singapore (NTU Singapore), LKCmedicine, Imperial College London, and NHG welcomed the young doctors to the healthcare family in Singapore, and to serve on the frontlines of the COVID-19 pandemic. As the clinical training partner for LKCmedicine, NHG has been instrumental in preparing the cohort for the multi-factorial realities of medical care in Singapore – and I am sure the newest cohort will do us proud, particularly during this time of great national need for skilled, resilient, and compassionate doctors.

This year also marks 50 years since the advent of Child Psychiatry in Singapore – which has come a long way from an ad hoc, part-time service in 1970 to a full-fledged discipline with over 500 practitioners in Singapore, including consultant psychiatrists, psychiatric residents, psychologists, social workers, occupational therapists, and nurses. The milestone gains even more meaning in 2020 as Singapore will be the first South-East Asian country-host for the World Congress of the International Association for Child and Adolescent Psychiatry and Allied Professions – a virtual event co-organised by IMH.

In FY2019, we marked a historic first when in November 2019, LKCmedicine, NHG, and the National Neuroscience Institute (NNI) jointly launched Brain Bank Singapore – Singapore's first research repository of post-mortem brain and spinal cord tissues. The centre will delve into the areas of neurological disorders, such as Parkinson's and Alzheimer's disease, with the ultimate goal of improving health outcomes through prevention, early detection, and treatment of these debilitating conditions – particularly significant in an ageing population.

RECOGNISING EXCELLENCE ACROSS THE NHG FAMILY

Every year, Singapore honours its nurses – the backbone of our healthcare system – on 1 August, a day that marks the start of the development of nursing in our country, 135 years ago. In this time, our nurses have come a long way from providing bedside

“ I would like to acknowledge those within NHG, as well as our community partners, who have shouldered the task of continuing to provide healthcare services beyond infectious disease management – particularly for our patients with chronic illnesses.”

MADAM KAY KUOK
CHAIRMAN, NHG

care to taking on leadership roles as Advanced Practice Nurses, Nurse-Clinicians, Nursing Educators, and Community Nurses. They have, in the spirit of continuous learning, constantly upgraded their skillsets and expertise to keep up with the changing healthcare landscape, even becoming the driving force of much-needed systemic change in our hospitals and clinics, as well as in the community. Now more than ever, the roles and contributions of nurses have amplified since the discovery of the first COVID-19 patient in Singapore, on 23 January. They have been working unceasingly across the nation, swabbing, contact tracing, triaging patients, and providing clinical care.

It gives me great joy to note that Ms Kala D/O Narayanasamy, Deputy Director of Nursing, WHC, was one of five nurses honoured with the President's Award for Nurses this year. It is the highest accolade

BELOW LKCmedicine, NHG and NNI jointly launched Brain Bank Singapore.





for Singapore’s Nursing profession, and for nurses who have shown sustained outstanding performance and contributions to patient care delivery, education, research, and administration. In the on-going battle against COVID-19, Ms Kala drew on her experience during the SARS outbreak to devise workflows and protocols to convert wards at Yishun Community Hospital (YCH) to care for patients. NHG, public healthcare, and the nation thank Ms Kala, and the many nurses like her, for their selfless service.

I would also like to offer my heartiest congratulations to the more than 169 Senior Management and Staff from the NHG Family who were among the National Day Awards recipients this year. This remarkable list includes NHG Board Member Mr Gabriel Lim, NCID’s Executive Director Professor Leo Yee Sin, among other worthy recipients. All our awardees are paragons of service who have demonstrated great leadership and sacrifice in keeping Singapore safe during this pandemic.

Two of our own were also honoured at the prestigious National Medical Excellence Awards 2020, a national-level award



that recognises the efforts of outstanding clinicians, clinician-scientists, and other healthcare professionals for their achievements in advancing healthcare, improving the standards of patient safety, and driving research and education. Associate Professor Sum Chee Fang, Senior Consultant at KTPH’s Division of Endocrinology, and Diabetes Centre, Admiralty Medical Centre, was conferred the National Outstanding Clinician Award for his exemplary contributions to advancing diabetes and endocrinology care in Singapore. In addition, NHG Group Chief Education Officer and Chairman Medical Board, WHC, Associate Professor Nicholas Chew, received the National Outstanding Clinician Educator Award for his illustrious commitment to training, mentoring, and developing healthcare professionals, and augmenting the capabilities of the public healthcare system. The NHG Family congratulates them on winning these distinguished accolades.

NHG and our Institutions also clinched eight awards at APEX 2020, an annual US-based competition which recognises excellence in publishing. This year, APEX received over 1,200 entries from professional communicators worldwide. I commend the teams from NHG Group Corporate

TOP Radiographers from NHGD volunteered to work at Community Care Facilities.

RIGHT NHG HQ staff sewing masks for visitors to NHG Institutions.

BELOW Ms Kala D/O Narayanasamy (centre), Deputy Director of Nursing, WHC, lauded with the President’s Award for Nurses this year.





Communications, IMH, Yishun Health, and NHGP for putting together publications that stood out in their quality and content. More importantly, I am happy that NHG's message of *Adding Years of Healthy Life* continues to be disseminated far and wide.

MOVING FORWARD AS ONE FAMILY

Finally, I would like to express my appreciation to Mr Soh Gim Teik and Mr Seow Choke Meng, and Mr Robert Chew for their dedication and contributions during their tenure on the NHG Board. I would also like to warmly welcome our new Members, Mdm Zuraidah Abdullah and Ms Lillian Lee, to the NHG Family.

I wish to extend my heartfelt thanks to each and every one of you – doctors, nurses, Allied Health Professionals, finance, IT, operations, housekeeping, quality, education, human resource, communications, and support administration staff – for your on-going

hard work and dedication to the health and well-being of the patients and population under our care during this COVID-19 pandemic.

I know that everyone is going the extra mile during this time to serve Singapore. However, as you work around the clock to care for the patients and population in our charge, I urge each of you to take good care of yourself and each other. The COVID-19 battle is a marathon, not a sprint. Although Singapore has come far in bringing the pandemic under control, we are a long way from the finishing line.

As the country progressively reopens, and travel resumes, we will no doubt face the possibility of greater community transmission. Let us continue to stay disciplined and vigilant, act responsibly, observe safe distancing as we carry on with our daily activities, and not let complacency undermine all our good efforts. The NHG Board and Management stand in solidarity with all of you during these challenging times. By embracing collective leadership across all roles, and at every level, and by practising our values of People-Centredness, Integrity, Compassion, and Stewardship, we will not only meet the challenge but but would emerge stronger. Together – and now more than ever – let us strive on to *Add Years of Healthy Life* for our patients, the population, and the nation.

BELOW TTSH-NCID staff at the TTSH Helipad while the Republic of Singapore Air Force performed the Roar of Unity as a tribute to frontline fighters and essential workers during NDP2020.



GROUP CEO'S MESSAGE

Singapore confirmed its first COVID-19 case on 23 January 2020. Since then, the pandemic has proven to be a tremendous test of our leadership, stewardship, teamwork, resolve, and grit as NHG continues to battle it on the frontlines to keep Singapore safe. It is the toughest crisis ever faced in healthcare, and is deeply impacting our nation and the world. Some countries continue to struggle with surging numbers of cases and deaths,



while many others now grapple with second or third waves of COVID-19 outbreaks. Though the situation in Singapore has improved and we are in Phase 2 – Safe Transition, the crisis is far from over. With the re-opening of our borders and economy, Singapore can expect an influx of new cases, and potential new community outbreaks. When this happens, early detection and swift containment of spread are key to reducing transmission in the community. The country is also experiencing a severe economic downturn with business closures, job losses, and unemployment. To-date, our Government has injected more than \$100 billion from State Reserves to “save lives and livelihoods” affected by the COVID-19 pandemic.



PROFESSOR PHILIP CHOO
GROUP CHIEF EXECUTIVE OFFICER
National Healthcare Group



Global scientific and medical institutes, including Tan Tock Seng Hospital (TTSH) and the National Centre for Infectious Diseases (NCID) with renowned collaborators, are still researching and developing treatments and a safe and effective vaccine for COVID-19. Until then, we have to stay vigilant and gird ourselves for the long journey ahead.

Despite these tumultuous times, the NHG Family has rallied as one, breaking new ground under extraordinary circumstances and transforming the way we deliver care.

COLLECTIVE EXPERIENCE ON COVID-19

Since the start of the outbreak, clinical and non-clinical staff from TTSH, NCID, Yishun Health, Woodlands Health Campus (WHC), National Healthcare Group Polyclinics (NHGP), National Skin Centre (NSC), Institute of Mental Health (IMH), NHG Pharmacy (NHGPh), NHG Diagnostics (NHGD), and NHG HQ have stood in solidarity to manage the crisis.

At the epicentre of the national COVID-19 response, NCID together with TTSH were quick to integrate clinical and operational support including manpower, expertise, and resources. In the early days of the outbreak, suspect cases were tested at TTSH's Emergency Department (ED) and conveyed to NCID for isolation through the custom-designed bridge connecting the two buildings. Polymerase Chain Reaction (PCR) testing for the coronavirus – initially conducted only by the National Public Health Laboratory (NPHL) located in NCID – was subsequently transferred to TTSH's Department of Laboratory Medicine to scale up clinical testing capacity for both institutions.

When an increase of cases was anticipated, TTSH set up its Integrated Operations Coordinating Platform (IOCP) comprising leadership across the hospital



“Despite these tumultuous times, the NHG Family has rallied as one, breaking new ground under extraordinary circumstances and transforming the way we deliver care.”

PROFESSOR PHILIP CHOO
GROUP CEO, NHG

and NCID, and commenced joint command operations. To further augment the outbreak response at NCID, TTSH reduced its Business-as-Usual (BAU) operations to make available critical manpower and resources. COVID-19 screening operations were then transferred from the TTSH ED to the purpose-built Screening Centre at NCID to boost efficiency in detecting positive cases. The hospital also designated two floors of its general wards as outbreak wards, and converted selected wards to intensive care units (ICUs) to ramp up capacity for those critically ill. At the height of the outbreak, TTSH and NCID were managing about 50 to 70 per cent of the national workload for COVID-19 patients who required hospital care. The headcount deployed from TTSH to NCID was more than 1,515 Full-Time Equivalents (FTEs), with some 35 FTEs from NHG Institutions, and more than 65 FTEs from the other two clusters.

To meet urgent manpower needs, NHG scaled back its BAU activities and suspended elective services across the

LEFT Handmade
“Thank You” notes from
the community to NSC.

cluster. Clinical staff in all our Institutions underwent relevant training to be cross-deployed to wards and departments that required support. At Yishun Health, 50 to 70 per cent of inpatient wards were converted to manage COVID-19 related cases. Woodlands Health Campus (WHC), which is nested there, also altered two of its general wards to COVID-19 wards.

In a mutually beneficial move, Khoo Teck Puat Hospital (KTPH) enlisted Singapore Airlines, SilkAir, and Scoot flight attendants to serve as Care Ambassadors. Temporarily grounded amid the outbreak, these attendants were assigned to low-risk wards and trained to provide basic caregiving, nutritional care and patient service. Cabin crew from Jetstar also contributed as Service Support Officers, assisting KTPH on various operational needs. The success of the initiative has led to its roll-out at other public hospitals.

When COVID-19 outbreaks were detected among the migrant worker population in Singapore, NHG responded to the national call to set up the Community Care Facility (CCF) at Singapore EXPO, and Swab Isolation Facilities (SIFs) and Community Recovery Facilities (CRFs) in Purpose-Built Dormitories (PBDs), hotels, and resorts. We established the facilities in record time, collaborating with the Ministry of Health (MOH), the Inter-agency Taskforce (ITF), and the private sector.

The CCF, for example, took WHC and its partners just five days to plan and set up. Its two halls were able to accommodate 950 patients. Doctors and nurses managed triage and admission, conducted swab tests, and took patients' vitals to monitor their condition. Patients who exhibited worsening symptoms were sent to hospital, while those who remained well two weeks after diagnosis and did not require further medical care were transferred to a step-down CRF to continue their isolation. The WHC clinical team was reinforced by counterparts from NSC, IMH, Singapore Armed Forces (SAF) Medical Corps, Health Promotion Board (HPB), and other public hospitals and private practices. Non-clinical staff from WHC also lent logistic and administrative support to ensure smooth operations.



LEFT Ms Chan Soo Chung, Executive Director, NHG Pharmacy and volunteers packing medication during COVID-19.

BELOW Care Ambassadors from SIA Group at KTPH.





Over at the 14 PBDs placed under our care, NHGP's teams of medical, nursing, and administration staff set up medical posts to triage and swab-test migrant workers. Bolstered by colleagues from other NHG Institutions, private healthcare and locums, the medical teams supported on COVID-19 management, ensuring that some 100,000 migrant workers had access to acute care, and received attention for their chronic conditions, as well as mental health needs. NHG pharmacists augmented with on-site dispensaries, with a core team at Yishun Polyclinic managing and coordinating NHG's overall logistics and medication supplies for the migrant workers. Recognising the massive operations taking place at these facilities, non-clinical staff across our cluster volunteered and were deployed to boost manpower at the frontlines.

A key strategy in Singapore's COVID-19 response is early detection from active surveillance and routine testing of targeted groups, and expanded testing for those diagnosed with acute respiratory infection. This helps safeguard the health and safety of the larger public. NHG and its Institutions contributed to the rigorous testing regime with the conduct of mass swabbing operations across Singapore, covering numerous SIFs, PBDs, and nursing homes with COVID-19 cases.

Our close partnership with private healthcare groups was crucial for our

effective management of the coronavirus outbreak at the dormitories. As part of the transitioning for care arrangements, we handed over the dormitories' medical support management to Fullerton Health Group and SATA as of 23 July 2020. By September 2020, the medical support for PBDs was fully helmed by the Ministry of Manpower (MOM).

Throughout our clinical modus operandi at the dormitories – more than 100 days – not one NHG staff member was diagnosed with COVID-19 in the line of duty. This positive outcome was testament of our work as one NHG Family, bound by a common purpose, courage, commitment, and professionalism, while emphasising personal hygiene, and collective health and safety with strict infection control and safe distancing measures in place, regardless of setting.

I would like to thank all leaders and our people across NHG for staying focused in the face of adversity, and collaborating effectively as one team with the Multi-Ministry Taskforce, and ITF. I salute all our frontline heroes, and I am also grateful for the unwavering support from our non-clinical staff, from research, operations, procurement, finance, human resource, communications, IT, facilities maintenance and security, to administration. Equally humbling are the many words of encouragement, and outpouring of care and acts of kindness from our business partners, and friends in the community, which have brought us much cheer and hope, and kept us resolute and resilient in overcoming tough times.

As a nation, it was heartening to celebrate our National Day on 9 August amid COVID-19. Done differently but no less significant, the National Day Parade (NDP) 2020 saw multiple tributes paid to our frontline fighters. Our Institutions



TOP A/Prof Steven Thng with frontline staff at one of the migrant worker dormitories.

RIGHT KTPH contact tracers at the start of the COVID-19 outbreak.

and people were recognised for their contributions with special moments including flypasts over TTSH/NCID and KTPH, and “rolling salutes” from the SAF mobile columns when they went past KTPH and the WHC-CCF @ Singapore EXPO. TTSH/NCID also represented the healthcare sector in the National Anthem Moment, as one of seven locations for the ceremony to thank frontliners for our response to COVID-19.

NOTABLE ACHIEVEMENTS IN FY2019

Even amidst a pandemic, NHG has marked its 20th anniversary on 1 April 2020. I am proud that our workforce continues to lead with People-Centredness, Integrity, Compassion, and Stewardship. These values have guided us in the way we operate, provide better care, and meet the health and social needs of our patients and the population we serve in the Central Region.

In FY2019, NHG and its Institutions made further inroads in research and innovation on several fronts.

On 10 October, NHG signed a Memorandum of Understanding (MOU) to establish a *Joint Programme for Translational Research* with the Nanyang Technological University (NTU) Lee Kong Chian School of Medicine (LKCMedicine) during the Singapore Health and Biomedical Congress (SHBC) 2019. Leveraging strategically on the expertise and resources of both partners, the Joint Programme will streamline the setting up of joint translational research centres to improve health outcomes for six areas: Ageing/ Rehabilitation, Dermatology, Infectious Diseases, Mental Health, Metabolic-Vascular Diseases, and Population Health.

Fortifying our goal to future-proof healthcare with digital technologies is TTSH’s *Command, Control and Communications (C3) System*, launched at its integrated Operations Command Centre in December 2019. This world-first smart hospital system analyses data from Real-Time Location System sensors and CCTV video footage, and uses artificial intelligence (AI) to predict bottlenecks. With the continual streaming of data from different hospital systems, C3 provides real-time situational awareness of the overall operations. During the COVID-19 pandemic, it has enabled the hospital to better plan and deploy its resources – as well as coordinate the surge demand at



TOP & LEFT NHG staff participating in NDP2020.



BELOW TTSH’s *Command, Control and Communications (C3) System* was launched at its integrated Operations Command Centre in December 2019.

NCID – while still providing regular and timely critical care for patients. The system won the Excellence Champion Medal at the 2020 National Healthcare Innovation and Productivity Awards by MOH.

The hospital also successfully deployed its *Smart Bed-Exit Prediction and Prevention System (PreSAGE)*, which uses thermal sensing to provide round-the-clock automated surveillance for high fall-risk patients, in its general wards in September 2019. Trained on 12,000 hours of real patient thermal data, PreSAGE gives accurate early warning based on machine learning models and is projected to save up to 30





per cent nursing FTEs in falls prevention surveillance. Studies on the system have shown 99.7 per cent sensitivity and 100 per cent specificity. PreSAGE won the 2019 HIMSS-Elsevier Digital Healthcare Award in the Outstanding Innovation category.

Our on-going efforts in care transformation have also resulted in commendable outcomes. Over the past 20 years, NHGP has been working hard to achieve a future-ready primary care ecosystem, one that is sustainable, accessible, and effective in improving population health. It has been harnessing technology such as telehealth to better serve our patients and community residents. The expansion of more such services like Tele-Consults, Tele-Dietetics, Tele-Psychology, and Tele-Wound, has realised very tangible benefits, especially during the pandemic. They reduce patients' visits to polyclinics, without compromising their need for timely and appropriate treatments. Patients appreciate the convenience, feel safe and more empowered to monitor their own health and keep well.

Complementing the push for telehealth, NHGPh has ramped up its medication home delivery service. It has seen a 50-fold increase in requests by patients since the start of the coronavirus outbreak. Currently, the Central Fill Pharmacy handles some 50 per cent of the requests, and this has freed up NHGPh staff's time to devote more attention to patient care and value-add services at the polyclinics.

NHGD has also improved care for the community with its home phlebotomy service, which brings blood tests for non-ambulatory patients within easy reach. It conducts an average of 50 visits a month.

The service was recognised with the Dare to Do Award at the 2019 Public Sector Transformation Awards.

To promote better self-care in skin health, NSC developed a novel scalp spray and facial product under the Suu Balm brand for persons with eczema, one of the most common skin conditions in Singapore. Both products are now available in Asia and in Ireland.

At Yishun Health, productivity and efficiency increased when a ward in Yishun Community Hospital (YCH) was converted into an acute ward in September 2019. This resulted in 94 per cent of acute patients being admitted within four hours, and at least 80 per cent of them were transferred from KTPH to YCH within a day. This initiative saved Yishun Health about \$2.3 million in overall costs. By innovating other aspects of its operations, Yishun Health was also able to lower its rate of hospital readmission (within 30 days of discharge) to 9.1 per cent as compared to the national average of 11.1 per cent between January and September 2019. For the same period, the campus successfully maintained a zero per cent rate of patients waiting more than 60 days for new subsidised Specialist Outpatient Clinic (SOC) appointments, which was much lower than the national average of 12.2 per cent.

In preparation of its phased opening in 2023, WHC has opened wards 82 and 86, and ward D57 at its nesting sites in TTSH and YCH, respectively. These bring the total number of WHC's pre-operation wards to six, to train and shore up its clinical and operational expertise.

In line with Better People, Better Care, we have been building our people's

TOP LEFT An NHGP doctor conducting tele-consultation at Ang Mo Kio Polyclinic.



“ We have achieved things we thought impossible, simplified processes, accelerated solutions to care delivery, and learnt and grown exponentially as an organisation, as ONE Family.”

PROFESSOR PHILIP CHOO
GROUP CEO, NHG





capacity and capability to enable relationship-based healthcare. More than 500 senior leaders have participated in the NHG Collective Leadership Programme since it first started in August 2018. The COVID-19 outbreak has been a litmus test to apply knowledge into practice, with our NHG Family faring well as partners in the management of national crises.

Our Institutions have continued to promote staff well-being and continuing education. Accolades received in the past year bear testimony to our various initiatives. TTSH won the Singapore HEALTH Excellence Award in recognition for its exemplary efforts in promoting workplace health, while IMH successfully obtained re-accreditation by the American Nurses Credentialing Center (ANCC) as a provider of nursing continuing professional development.

GEARING UP FOR THE FUTURE

THE NEXT GENERATION ELECTRONIC MEDICAL RECORDS (NGEMR)

The growing number of people living with chronic conditions and increasing demand for healthcare services mean that existing healthcare IT infrastructure such as the Electronic Medical Record (EMR) needs to be enhanced. Thus, NHG is working to deploy the Next Generation Electronic Medical Records (NGEMR), a joint project with MOH, Integrated Health Information Systems (IHIS), and National University Health System (NUHS).

The NGEMR will replace almost all the existing clinical systems in NHG and combine the different functionalities

into a single platform. It will facilitate information sharing and exchange across NHG's Institutions and our partners, and enable the use of data analytics and decision support to deliver better care. It will also revolutionise and standardise the way healthcare staff collect patient and medical data safely and securely, and how they access patient medical records.

Patients can look forward to a more seamless care experience through tools and functionalities like self-service appointment management, access to education materials, e-Check-In, and care plans. There is much potential for patient empowerment and personalised care with the marrying of informatics and healthcare.

With the successful start of NGEMR by Jurong Health in February 2020, the system would progressively be rolled out across NHG Institutions in the next few years.

ACCELERATING DIGITAL TELEHEALTH SERVICES

The COVID-19 pandemic has created a need for accelerating digital telehealth services, and NHG is keeping abreast with the latest developments. We have embarked on our NHG Digital Applications Platform Launch Project and will be developing an app in the coming months. The app is being designed to enhance patient experience and care delivery, including links to Healthhub e-services. Patients, carers, and even volunteers would be able to personalise the features in the app for positive health outcomes.

LEADERSHIP CHANGES

2020 has seen new changes in the NHG leadership. I would like to extend my gratitude to Professor Lim Tock Han, who stepped down in June 2020 after completing his term as Deputy Group





NHG, in April 2020. Her vast experience in primary care and public health would enhance our understanding of the multi-faceted health status our patients and population, thereby strengthening our provision of holistic, accessible, and quality care to the community.

NHG20: TORCH OF HOPE

While this unprecedented crisis has hit all of us hard, it has unleashed hidden potential in our people as well. We have achieved things we thought impossible, simplified processes, accelerated solutions to care delivery, learnt and grown exponentially as an organisation, as ONE Family.

To foster social connectedness and camaraderie, Group Corporate Communications produced a NHG20 'Torch of Hope' music video to commemorate our 20th anniversary. It is an uplifting chorus of voices with representatives from every institution. Their faces display hope, resilience, and strong bonds forged through adversity. The song also seeks to encourage frontliners, patients, and the public to be strong and united in overcoming this pandemic.

Let us remain unswerving and unfaltering in service as we continue our journey towards Phase Three. Let us keep an open mind, adjust our expectations, lifestyles and norms, stay vigilant, and practise good social responsibility. TOGETHER, WE SHALL OVERCOME COVID-19.

CEO for Education and Research, NHG. Professor Lim spearheaded the growth and development of a robust and innovative research culture across the cluster and beyond, and also championed the continuing education of clinicians and non-clinical staff alike.

Taking over the mantle from Professor Lim is Dr Benjamin Seet, who joined us in January 2020 and has since helped lead the overall NHG response to the COVID-19 crisis. I welcome him to the NHG Family and trust he will contribute further through his diverse roles in the organisation.

I would also like to congratulate Mr Yong Keng Kwang, who was appointed Group Chief Nurse (GCN), NHG, on 1 October 2020. Formerly Chief Nurse at TTSH & Central Health, he helms the NHG Group Nursing (GN) team and will collaborate closely with nursing leaders across the cluster to improve health outcomes of our population through nurse-led initiatives and transformative care.

We welcome Dr Elaine Tan, who was appointed Deputy COO (Population Health),

BELOW Prof Leo Yee Sin, Executive Director, NCID, with frontline staff at NCID.



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MR GIRIJA PANDE
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DR TAN KHAİ TONG
National Healthcare Group



MS CHU SWEE YEOK
National Healthcare Group

Our appreciation to former NHG Board Members Mr Soh Gim Teik and Mr Seow Choke Meng for completing their tenure as of April 2020, and Mr Robert Chew for completing his tenure as of September 2020.



MR NG HOW YUE
National Healthcare Group



MR GABRIEL LIM
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EXECUTIVE DIRECTOR
National Centre for
Infectious Diseases



A/PROF THOMAS LEW
GROUP CHIEF DATA AND
STRATEGY OFFICER
National Healthcare Group



ASST PROF ERIC WONG
GROUP CHIEF CLINICAL
INFORMATICS OFFICER
National Healthcare Group



MR HUAN BOON KEAN
GROUP CHIEF
INFORMATION OFFICER
National Healthcare Group



DR SIMON LEE
CHIEF OPERATING
OFFICER & CHIEF CLINICAL
INFORMATICS OFFICER
National Healthcare
Group Polyclinics



MR LIM HOCK LENG
CHIEF OPERATING OFFICER
Institute of Mental Health



DR ELAINE TAN
DEPUTY CHIEF
OPERATING OFFICER,
POPULATION HEALTH
National Healthcare Group



DR HENG BEE HOON
SENIOR DIRECTOR, HEALTH
SERVICES & OUTCOMES
RESEARCH (HSOR)
National Healthcare Group

Our appreciation to former Deputy Group CEO (Education and Research)
Professor Lim Tock Han for completing his tenure as of June 2020.



DR BENJAMIN SEET
DEPUTY GROUP CHIEF
EXECUTIVE OFFICER
(EDUCATION AND RESEARCH)
National Healthcare Group



PROF EUGENE FIDELIS SOH
CHIEF EXECUTIVE OFFICER
Tan Tock Seng Hospital
& Central Health



MRS CHEW KWEE TIANG
CHIEF EXECUTIVE OFFICER
Khoo Teck Puat Hospital
& Yishun Health



A/PROF CHONG PHUI-NAH
CHIEF EXECUTIVE OFFICER
National Healthcare Group
Polyclinics & Primary Care



PROF TAN SUAT HOON
DIRECTOR
National Skin Centre



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DR JAMIE MERVYN LIM
CHIEF OPERATING OFFICER
Tan Tock Seng Hospital
& Central Health



MS YEN TAN
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& Yishun Health



DR KAREN NG
DIRECTOR, CLINICAL
SERVICES
National Healthcare Group
Polyclinics



MS CHAN SOO CHUNG
EXECUTIVE DIRECTOR
National Healthcare Group
Pharmacy



MS LIM SOH HAR
EXECUTIVE DIRECTOR
National Healthcare
Group Diagnostics

COVID-19 SPECIAL

TOGETHER, STRONGER, TO BATTLE COVID-19

“Some nights when I could not sleep worrying about the long and daunting pandemic, knowing how hard everyone worked gave me the added impetus to strive harder. You uplifted me, and gave me renewed hope.”

PROFESSOR PHILIP CHOO
GROUP CEO, NHG





WHY SINGAPORE IS BETTER PREPARED TO HANDLE COVID-19 THAN SARS

Lessons learnt from SARS and investments in science, research, and technology have provided game-changers for Singapore, says Dr Benjamin Seet, Deputy Group CEO (Education & Research), NHG.

On 1 March 2003, SARS hit Singapore. Over the next four months, we witnessed its spread through public hospitals and the community, infecting 238 people with 33 succumbing to the virus.

I lost a close friend, Alex, whom I had known since Primary One. A visit

by an overseas scientist further led to my being issued a Home Quarantine Order, and with that, the obligatory daily reporting before a CISCO video surveillance camera.

DEALING WITH SARS

Singapore's biomedical scene was fledgling then - the first buildings in Biopolis were newly constructed.

Notwithstanding, scientists at the Agency for Science, Technology and Research (A*STAR) became one of the first globally to sequence and genetically map the SARS virus as well as develop a commercial test kit (with Roche Diagnostics).

We witnessed the mobilisation of the Singapore Armed Forces (SAF) to support contact tracing, electronic tagging of quarantine breakers and the conversion of military thermal sights to the now pervasive fever scanners. Novel research, clever engineering, good old-fashioned public health measures and the Singapore brand of public policy ensured that we beat the virus.

Singapore was declared SARS-free by the World Health Organization (WHO) on 30 May 2003 - three months after the virus had arrived on the island.

Seventeen years on, we face a global pandemic. What has changed this time is that Singapore is now ranked as one of the top biotech and innovation locations globally - and that we are pulling above our weight to make a difference. We are also more prepared than before to deal with this outbreak.

DETECTING THE VIRUS

The Bioinformatics Institute at A*STAR supports the GISAID (Global Initiative on Sharing All Influenza Data) database, where genetic sequences of the COVID-19 virus are uploaded and shared.

This permits analysis of how the virus mutates as it spreads geographically and over time, providing molecular clues as to how best to deal with it, as well as a precision tool to augment contact tracing.

Working closely with the National Centre for Infectious Diseases (NCID), scientists at Duke-NUS Medical School successfully cultured the COVID-19 virus just one week after it landed in Singapore on 23 January 2020.

This group went on to become the first globally to develop a serological test for COVID-19, which detects antibodies produced by the body's immune response against the virus, setting the stage for rapid testing and population surveillance.





“What has changed this time is that Singapore is now ranked as one of the top biotech and innovation locations globally – and that we are pulling above our weight to make a difference.”

The National Public Health Laboratory, together with the public hospitals, developed and ramped up a diagnostic test for the virus in January 2020 that has allowed the Ministry of Health (MOH) to carry out tests, boosting our ability to detect infected cases.

Research laboratories across the island also joined the international race to develop diagnostic kits for laboratory use.

An A*STAR kit, jointly developed with Tan Tock Seng Hospital (TTSH), was deployed in public hospitals by early February, while 10,000 tests were shipped to support efforts in China.

Local biotech firms, Veredus and Acumen Research Laboratories

announced their prototypes within weeks of the outbreak. The Veredus kit received its provisional licence just one month later, and was deployed by the Home Team in its laboratories to support screening at border checkpoints by early March.

A reliable diagnostic test is critical for outbreak and patient management.

The challenge remains that current tests are laboratory-based, which take time and entail additional logistics. Ideally, we want a point-of-care test with rapid turn-around time – somewhat like a pregnancy test kit.

This will enable doctors at the frontline to diagnose COVID-19 in their clinics without having to send samples

TOP Prof Philip Choo, Group CEO, NHG, and NHG Senior Management walking the ground at one of the migrant dormitories.

to hospital laboratories. One technical barrier is that such a test demands high sensitivity, so that we do not miss positive cases.

COMING UP WITH A CURE

The COVID-19 virus is a novel one. About 20 per cent of patients develop serious illness and complications, and case fatality ranges from less than 1 per cent to as high as 4 per cent.

A distant cousin of other coronaviruses like SARS and MERS, there is currently no proven treatment or vaccine for COVID-19. Given the high standards of care in our hospitals, as well as the tight network of public and university labs, Singapore offers advantages for companies to conduct drug development here.

US biotech firm, Gilead Sciences, announced that it would be widening clinical trials here for its anti-viral drug, called *Remdesivir*, for the treatment of COVID-19. This trial involves the NCID and other public



hospitals, providing patients here with early access to the drug.

NCID will also support a leading biotech company's push to develop an antibody treatment against the virus. Duke-NUS Medical School has announced that it will work with the Coalition for Epidemic Preparedness Innovations, and with US biotech company, Arcturus Therapeutics, to develop vaccines for COVID-19.

ON THE DIGITAL FRONT

The fight against COVID-19 extends to the digital arena. Over at the integrated TTSH Operations Command Centre, data is continually streamed from different hospital systems, providing real-time situational awareness of its overall operations.

This has enabled local health authorities and TTSH to better plan and coordinate for the surge demand at NCID, deploying over 1,000 staff to support frontline screening and treatment in the outbreak wards, while still providing regular hospital care for patients.

The new Real Time Location System, a tracking system, further

strengthens the process of contact tracing. Doctors at TTSH are also working with A*STAR to potentially employ computer vision and deep learning to detect lung infection on chest x-rays. This would enhance screening at NCID, and potentially in primary care, in the event of widespread community transmission of COVID-19.

Another innovation is the design and rapid prototyping of face shields to replace goggles used by staff managing COVID-19 cases. Wearing goggles for prolonged periods can lead to discomfort and facial imprints. This led a team from TTSH and NCID to leverage on 3D printing to develop cost-effective face shields for better protection, fit and comfort.

On a wider scale, we now face an information pandemic, comprising health advisories, scientific communications and a social media maelstrom generously peppered with fake news.

One Chinese website has drawn close to three billion views, providing almost real-time count of infection numbers in every province and city,

as well as countries across the globe.

Official updates from MOH now come through both traditional and social media, while educational content from our universities are available online. All of these help counter the disinformation that digital channels might otherwise help proliferate.


Chinese netizens have commented that Singapore's handling of COVID-19 has been "zen".

Singapore's approach has garnered praise from the WHO and international experts.

I would put forth the view that SARS taught us the important lesson of needing to be prepared, and that our investments in science, research, and technology have provided game-changers which have made a difference.

*Dr Benjamin Seet is the Deputy Group CEO (Education & Research) at the National Healthcare Group in Singapore. He was formerly Executive Director of the Biomedical Research Council at A*STAR.*

Source: CNA (www.channelnewsasia.com). Article first published on 17 March 2020.



“ Many of our staff have placed patients and public interest before their own to battle the COVID-19 pandemic at the frontline. I’m very grateful and proud of their dedication, commitment, and professionalism. Though we are far from the finishing line, do remember that we are all in this as one family. Together, we shall overcome. Until then, stay safe, healthy, and strong.”

ASSOCIATE PROFESSOR CHONG PHUI-NAH
CEO, NATIONAL HEALTHCARE GROUP POLYCLINICS & PRIMARY CARE

ALL HANDS ON DECK

In Singapore's battle to overcome COVID-19, NHG mounted a cluster-wide coordination effort to meet the scale, complexity, and urgency of the crisis.

About nine months after registering its first confirmed case on 23 January 2020, Singapore remains in the grip of the coronavirus (COVID-19) pandemic. The situation initially seemed to be under control – thanks to a combination of scaled-up testing and contact tracing, quarantine and isolation orders, safe distancing measures, and a top-notch

healthcare system that kept a lid on local transmission. But just when it looked like the tide had begun to turn against COVID-19, infections among migrant workers living in cramped dormitories in late March and early April diminished the hope of averting a bigger crisis.

The number of new daily cases at double-digits, soon exceeded 1,000. Total cases surged from 226 in mid-March to more than 16,000 by

the end of April. "In a few short weeks, Singapore went from being a model for containing COVID-19 to one of the worst-hit countries in Asia," said Dr Benjamin Seet, Deputy Group CEO (Education and Research), NHG.

This 'one step forward, two steps back' predicament resulted in more than 57,500 cases and 27 deaths as of 2 October 2020, and placed a heavy burden on Singapore's healthcare system. Hospitals had to quickly reconfigure operations to handle the influx of cases, while continuing to provide regular care for other patients. To reduce the COVID-19 patient load in hospitals, healthcare workers were roped into a whole-of-nation response to set up and run makeshift care facilities in the community.

NHG was naturally a key partner in this all-round effort, with Dr Seet heading the Group's overall response to the pandemic. From the start of the outbreak, clinical and non-clinical staff from Tan Tock Seng Hospital (TTSH), National Centre for Infectious Diseases (NCID), Yishun Health, Woodlands Health Campus (WHC), National Healthcare Group Polyclinics (NHGP), National Skin Centre (NSC), Institute of Mental Health (IMH), NHG Pharmacy (NHGPh) and NHG Diagnostics (NHGD) had to join forces to manage the crisis. Many went the extra mile, above and beyond their normal roles, to serve patients and the nation.

AT THE EPICENTRE

Long-serving staff of TTSH must have experienced a sense of *déjà vu*, laced with painful memories, when the first few imported COVID-19 cases landed on Singapore's shores. The hospital had served as 'ground zero' during the 2003 SARS and 2009 H1N1 epidemics. But in the current pandemic, TTSH had a new partner to help hold the fort – the state-of-the-art, 330-bed NCID, which officially opened in September 2019. "NCID is fully integrated with TTSH to enable clinical and operational support including expertise, manpower and resources," said Professor Eugene Fidelis Soh, CEO of TTSH and Central Health.

It soon became evident that the segregated fever screening area at TTSH's Emergency Department (ED)



ABOVE WHC staff attending to patients at the CCF @ Singapore Expo.



“For us in NHG, battling the COVID-19 pandemic for the past few months was a tremendous test of leadership, stewardship, teamwork, discipline, tenacity, perseverance, and fortitude.”

PROFESSOR PHILIP CHOO
GROUP CEO, NHG

would outrun its capacity when the numbers being screened for COVID-19 burgeoned. NCID thus opened its Screening Centre on 29 January, and erected a large tent outside its premises to meet the increasing demand for screening, while expanding its capacity for critical patients to 586 beds. Likewise, TTSH set aside two of its 13 floors to treat COVID-19 patients requiring acute care should NCID become full, and converted selected wards into intensive care units (ICUs) for the critically ill. Suspected or confirmed COVID-19 patients at TTSH and NCID were triaged and isolated in negative-pressure rooms.

To free up doctors and nurses for NCID, TTSH postponed non-urgent patient appointments and surgical procedures, and shut down temporarily selected wards. Chest X-ray machines and other equipment were also installed.

Staff across all TTSH departments were quick to step forward to play a part in the battle. Besides the clinical staff deployed to NCID, doctors and nurses attending to regular patients in the ED conducted enhanced pneumonia surveillance. To aid diagnosis, radiographers and laboratory staff worked round-the-clock to perform chest X-rays and test swab samples. Housekeeping staff pulled extra shifts to clean and disinfect isolation rooms and

high-touch areas across the hospital campus. Administration staff manned the entrance screening stations, where they assisted outpatients and visitors in declaring travel or contact history, and if they had any COVID-19 symptoms.

No stone was left unturned at Yishun Health, either. Towards the end of April, the screening wing of Khoo Teck Puat Hospital (KTPH) was extended from its Acute and Emergency (A&E) Care Centre to the adjoining lobby of Yishun Community Hospital (YCH). Surgical and dental staff were deployed to work alongside their A&E colleagues. Ancillary teams, such as Facilities Management and Security, also punched above their weight to provide the necessary infrastructure support.

“From the first day, everyone at Yishun Health was very clear of our goals to strike a balance between caring for COVID-19 patients and those with acute conditions, as well as keeping every healthcare worker safe. We swiftly transformed our campus infrastructure and operations to respond to the evolving situation,” said Mrs Chew Kwee Tiang, CEO of KTPH and Yishun Health.

Allied Health Professionals (AHPs) were as critical as doctors and nurses on the frontlines, added Ms Teresa Foong, Head and Deputy Director, Allied Health Services & Pharmacy, Yishun Health. For example, dietitians gave advice on how to better plan meals for hospitalised COVID-19 patients, while physiotherapists helped with their functional recovery. Likewise at TTSH, AHPs at the screening centre supported nurses in taking patients’ parameters, swabbing, and patient transfer. Several were also deployed

DEVELOPMENT OF A DIAGNOSTIC TEST KIT FOR COVID-19

Scientists from the Agency for Science, Technology and Research (A*STAR) and TTSH developed a diagnostic test kit that detected the presence of the SARS-CoV-2 virus – which causes COVID-19 – quickly and with high accuracy. The test, *A*STAR Fortitude 2.0*, is a real-time Polymerase Chain Reaction (PCR) assay, and results are generated using a nasopharyngeal swab collected from patients. It supported the analysis of up to 188 samples per kit. *A*STAR Fortitude 2.0* was the first “ready-made” hospital lab diagnostic test kit which received Singapore’s Health Sciences Authority’s (HSA) Provisional Authorisation for clinical use. It was implemented in public hospitals in Singapore in February 2020, while 10,000 test kits were shipped to support efforts in China.



LEFT Prime Minister Lee Hsien Loong with Prof Leo Yee Sin, Executive Director, NCID, during a visit to NCID in January 2020.

to migrant worker dormitories to assist with registration, triage, and swabbing.

Additional manpower needs at NCID, TTSH, KTPH and YCH were filled by staff from WHC, NSC, and other local hospitals. "It was a privilege to be able to contribute to a cause bigger than ourselves. I was inspired by our doctors, nurses, allied health and administration staff who offered to go where help was most needed. I was sure that at the end of this battle, they would emerge as better healthcare professionals and, essentially, better people," said Professor Tan Suat Hoon, Director of NSC.

In an unconventional move, KTPH enlisted Singapore Airlines (SIA), SilkAir and Scoot flight attendants, who were temporarily grounded amid the outbreak in April 2020 to

serve as Care Ambassadors. They were assigned to low-risk wards and trained to carry out basic caregiving procedures, nutritional care and patient service management. Cabin crew from Jetstar also contributed as Service Support Officers, assisting the hospital with various operational needs. TTSH too collaborated with SIA, SilkAir, Scoot and Tiger Air to train Care Ambassadors on service management and basic nursing.

During this period of heightened alert, the safety of healthcare workers was crucial in protecting themselves and others from infection. Surveillance and protocols were stepped up to ensure these met the required infection control standards, including training for proper donning and doffing of Personal Protective Equipment (PPE) and good hand hygiene. And to keep up with the rapidly-evolving nature of the virus, workflows and standard operating procedures (SOPs) were constantly updated and disseminated.

That TTSH and NCID could get up and run so quickly, and mobilise support, was due to the meticulous preparations, drills and exercises that were carried out in 'peacetime', well before COVID-19 happened. "It is what happens between outbreaks that matters the most. It is in regular times that lessons must not be forgotten. With every crisis, we learn and get better at what we do," said Prof Soh.

SUPPORTING FRONTLINE STAFF

Anxiety, fear, and loneliness were some of the emotions that frontline workers faced in the course of their work during the COVID-19 pandemic. To safeguard the mental wellness of these workers, TTSH, NCID, KTPH and WHC ramped up their existing programmes to provide more effective preventive and early mental health interventions for those who faced the risk of burnout, compassion fatigue and trauma.

The TTSH Staff Support Staff (3S) programme was helmed by representatives from various departments such as Psychology, Care & Counselling, HR Wellness and Psychiatry. "We learnt from SARS that healthcare workers could experience symptoms of post-traumatic stress disorder from working on the frontlines," explained Dr Lim Wen Phei, a Consultant at the hospital's Department of Psychiatry. "It was an important lesson in underscoring the need for mental health in ensuring a resilient healthcare workforce."

In March 2020, Dr Lim introduced a toolkit with the objective of psychologically preparing staff deployed to the COVID-19 screening centre and outbreak wards at NCID. Called *The Psychological*



TTSH RAMPS UP COVID-19 TESTING

The TTSH Department of Laboratory Medicine operated round-the-clock to ensure rapid turnaround of COVID-19 testing. This was crucial in providing timely care for confirmed cases and reducing anxiety among suspected cases. With 500 to 800 COVID-19 samples to test daily, additional staff were trained to run the tests. The department also expanded its capacity to perform 3,000 tests a day in support of NCID, community hospitals, nursing homes and polyclinics.

Preparedness Toolkit for Healthcare Workers, it had two versions: one for healthcare workers, and the other for healthcare supervisors responsible for looking after their teams' well-being. Staff had the 3S Helpline to call if they faced personal crises. The helpline was in operation before COVID-19, but its operating hours were expanded. It was manned 24 hours by qualified personnel, among them medical social workers, psychiatrists and psychologists.

At KTPH, a similar Peers Around Lending Support (PALS) programme extended systematic support for staff as they dealt with increasing work demands. The PALS team also bolstered efforts by starting outreach groups to educate staff about signs of stress, burnout and anxiety. "This fostered a sense of community and helped staff feel less alone," said Dr Goh Kah Hong, Head of Psychological Medicine, KTPH. "With early recognition, we had hoped they would be able to manage the stressors early and prevent them from escalating."

WHC set up a Staff Resilience and Organisational Growth (STRONG) taskforce to increase collective resilience and support among its staff. With each department having a representative on the taskforce, issues raised were more effectively

CUSTOMISED FACE SHIELD FOR BETTER PROTECTION

Goggles and face shields are important components of the PPE worn by frontline staff providing direct care to patients with COVID-19. Donning them for prolonged periods, however, caused wearers discomfort and facial imprints. To mitigate these issues, Centre for Healthcare Innovation (CHI), NCID and TTSH worked together to conceptualise a face shield prototype to replace the protective goggles. Crafted using 3D-printing, the face shield consists of a clear plastic sheet held up by a spectacle frame, an elastic band or a Velcro strip, and protects the wearer's face during risky procedures such as the suctioning of bodily fluids that could be potentially infectious. The prototype was modelled after an older face shield used during the severe acute respiratory syndrome (SARS) outbreak in 2003. It was tested as a pilot in February 2020.

“In the midst of this crisis, we were proud to be on the frontline, saving as many lives as possible. We were ready to chip in and contribute wherever help was needed, regardless of our peacetime role.”

ASSOCIATE PROFESSOR PEK WEE YANG
CHAIRMAN MEDICAL BOARD, KHOO TECK PUAT HOSPITAL & YISHUN HEALTH



addressed. A series of toolkits and infographics were provided to help staff cope better in their respective situations, with adequate training, psychological support and growth resources made available to all teams at the various sites.

UPON CLOSER SCRUTINY

As the dedicated national specialist centre for infectious diseases, NCID was the vanguard for all aspects of COVID-19 management — from public health functions, clinical care and diagnostics to research and operational considerations — and supported the Ministry of Health (MOH) in making evidence-based policy decisions. The National Public Health Laboratory (NPHL) at NCID served as the focal point for Singapore's COVID-19 testing activities. It successfully set up testing for COVID-19 before the virus was

confirmed and announced. Within one day of the SARS-CoV-2 sequence being released by China, NPHL had designed its specific SARS-CoV-2 assay, which was ready even before Singapore saw its first case.

Meanwhile, the National Public Health and Epidemiology Unit (NPHEU) at NCID continued to track reports related to COVID-19 from around the world, particularly those with high numbers of confirmed cases or deaths. The team at NPHEU also studied epidemiological data of COVID-19 cases admitted to NCID, contributing to the efforts by the MOH Epidemiology Team. These efforts helped to identify the associations between several local clusters and imported cases.

The clinical profiles of the initial COVID-19 cases admitted to NCID were used by NPHEU to look into the association between care needs



and age. There was an exponential increase in the proportion of cases who required oxygen support and intensive care with increasing age, particularly those above 50 years old. These findings guided NCID in its projection of ICU and bed capacity to meet surging demand between April and May when the outbreak at the dormitories was at its peak. The data analysis by NPHEU also enabled the identification of high-risk sub-populations and care needs to provide holistic care for patients.

One of the key pillars of COVID-19 related research conducted by NCID and its collaborators was PROTECT, a multi-centred prospective study to detect novel pathogens and characterise emerging infections.

PROTECT was applied in all public hospitals in Singapore, and it enabled the collection of information and biological samples from over 500 patients for research as of June 2020. The first PROTECT patient was recruited on 24 January 2020, just a day after Singapore reported its first confirmed COVID-19 case.

NCID's Executive Director, Professor Leo Yee Sin is one of Singapore's foremost infectious disease experts who previously helped to lead the nation's battle against SARS. She currently chairs a COVID-19 Research Workgroup set up in January to publish studies relevant to understanding the COVID-19 transmission in Singapore. The Workgroup is advised by MOH Chief Health Scientist Professor Tan

Chorh Chuan with members from MOH, DSO National Laboratories, and A*STAR.

To advance research on the transmission patterns, the Workgroup commissioned three seroepidemiological studies — which used antibody-based tests — to identify which population segments were exposed to COVID-19, and in what proportion:

- One study assessed the extent of COVID-19 exposure and infections among healthcare workers in Singapore. This would help evaluate the impact of varying degrees of exposure, and whether current measures to protect healthcare workers were adequate. Initial results from the study conducted at NCID, TTSH and National University Hospital (NUH) found no evidence that the workers had contracted the disease despite some providing direct care for COVID-19 patients or working in areas with some risk of exposure to the virus.
- A second study explored how widespread COVID-19 infection was in the community, particularly among children. This would help determine whether

A BRAND-NEW NERVE CENTRE

The TTSH Operations Command Centre was launched in December 2019. It features a world-first smart hospital system, C3 (Command, Control & Communications), that is able to integrate and coordinate patient care at a systemic level. C3's outbreak-scenario module was still being developed when COVID-19 struck, and enhancements to the system are still being made. Nevertheless, it gave TTSH an edge in communicating and coordinating hospital-wide operations. By analysing data from Real-Time Location System sensors and CCTV video footage, and using artificial intelligence (AI) to predict bottlenecks, C3 provided better visibility to help the hospital make timely decisions relating to flow management and resource optimisation during the pandemic. These included adjusting manpower distribution and ordering of critical supplies such as PPE.

“Everyone was just so united. We came from all over the hierarchy from different departments, but there was no drama or social alienation. When you're in a crisis, you fight together.”

MR JAMES ANG
SENIOR NURSE MANAGER,
EMERGENCY DEPARTMENT, TAN TOCK SENG HOSPITAL



ABOVE TTSH staff can call the 3S Helpline if they face personal crises.

UPLIFTING STAFF DURING COVID-19

NHG HQ put in place several initiatives to support our staff physically, mentally, and socially during the on-going COVID-19 pandemic. These included placing a team of peer supporters on stand-by for staff in distress, making sure staff had access to surgical masks and thermometers, collaborating with Institutions to prepare and distribute care packs, along with appreciation notes penned by Senior Management and colleagues. NHG HQ also tapped on Workplace by Facebook to share health tips and nudge staff to stay virtually connected while working from home. A *COVID-19 Heroes* series was launched on Workplace to highlight staff who exemplified our core values while supporting NHG's outbreak response efforts.

the SARS-CoV-2 virus in the hospital rooms of infected patients. Key findings demonstrated that the environmental contamination of SARS-CoV-2 peaked in the first week of illness for COVID-19 patients, and that the possibility of a patient infecting others through contaminated surfaces was negligible after the second week of illness. Researchers also discovered that the virus was detectable in the air surrounding patients in particles sized between 1 and 4 microns.

However, more research would be required to study the aerosolising potential of SARS-CoV-2.

THE BATTLEGROUND SHIFTS

The sharp rise in cases among migrant workers residing in dormitories (dorms) was unanticipated, but once identified, a whole-of-Singapore effort was initiated to tackle the problem. A range of measures was drawn up by the Government, and implemented across the public and private sectors, to increase healthcare

existing control measures were sufficient to protect adults as well as children. Preliminary results revealed that COVID-19 exposure in the community was extremely uncommon, indicating no widespread community transmission as of the last two weeks of March 2020.

- A third study looked into the exposure risk factors and prevalence of antibodies among persons at high risk of COVID-19 exposure, namely household and close contacts of confirmed cases. This would provide much-needed information for COVID-19 prevention policies. Of the 7,770 close contacts studied, the symptom-based PCR attack rate for household, work and social contacts was 5.9 per cent, 1.3 per cent and 1.3 per cent. Among household contacts, it was estimated that symptom-based testing missed 48 per cent of diagnoses and 28 per cent of SARS-CoV-2 infected persons were asymptomatic.

Another study conducted by NCID, in collaboration with Duke-NUS Medical School and DSO National Laboratories, investigated air and surface contamination by



capacity in the community and conserve hospital resources for those who needed them most.

As part of this endeavour, NHG waged the war on two fronts — one at NCID and in the hospitals, and another in the community. The latter efforts were focused on three areas:

- **Turning existing buildings into temporary healthcare facilities.**

For example, Community Care Facilities (CCFs) housed the majority of patients who tested positive for the virus, but who had mild or no symptoms and required minimal medical intervention. Those awaiting the results of their swab tests but who were unable to self-isolate within their dorms or homes were sent to Swab Isolation Facilities (SIFs), to prevent potential spread of the disease.

- **Providing on-site medical support at the dorms.**

Medical posts comprising doctors, nurses and AHPs were set up at all 43 purpose-built dormitories across Singapore. They tended to workers

who were unwell, swabbed those who displayed acute respiratory symptoms, and separated those who were infected or were suspected cases. That way, migrant workers could get prompt and appropriate medical treatment.

- **Mass swabbing at various locations around Singapore.**

Teams were deployed island-wide to conduct mass swabbing operations for the general population. Priority was given to those who presented the highest risk of infection, such as migrant workers, residents and employees of nursing homes, pre-school teachers and workers, as well as frontline healthcare workers. Testing was subsequently expanded to the rest of the essential workforce and the community at large.

REPURPOSING THE EXPO

On 10 April, the country's second CCF at Singapore EXPO began operations and received its initial batch of COVID-19 patients. Within five days, WHC together with multiple




agencies from the healthcare sector and external organisations, planned and set up two halls to house 950 patients.

Getting the facility ready in time would not have been possible, were it not for the work of all those involved — from infrastructure consultancy Surbana Jurong World Sentosa, to healthtech suppliers Integrated Health Information Systems (IHIS) and the MOH Office for Healthcare Transformation (MOHT). NHGD deployed its Mobile X-ray vehicle and a team of radiographers to Singapore EXPO, to enable



ABOVE (From left) Dr Jason Cheah, Deputy Group CEO (Transformation), NHG & CEO, WHC; Dr Wong Kirk Chuan, COO (Population Health), NHG & COO, WHC; Prof Philip Choo, Group CEO, NHG; and A/Prof Nicholas Chew, Group Chief Education Officer, NHG & CMB, WHC, at the CCF@EXPO.



“It is what happens between outbreaks that matters the most. It is in regular times that lessons must not be forgotten. With every crisis, we learn and get better at what we do.”

PROFESSOR EUGENE FIDELIS SOH
CEO, TAN TOCK SENG HOSPITAL & CENTRAL HEALTH

on-site X-ray examinations and fast turnaround of reports. Ms Lim Soh Har, Executive Director of NHGD, explained, “Besides providing timely X-ray diagnosis of patients with acute respiratory symptoms, the on-site X-ray service reduced unnecessary referrals to the hospitals.”

In anticipation of the increase in demand for on-site X-ray services as more halls were opened at Singapore EXPO to treat COVID-19 patients, NHGD converted its existing Mobile Bone Mineral Densitometry (BMD) trailer, whose service was suspended during DORSCON Orange, to Mobile X-ray II. In May 2020, the Mobile X-ray II was deployed to support the CCF at Tuas South.

On the medical side, WHC’s clinical staff were supplemented by counterparts from NSC, IMH, Singapore Armed Forces (SAF) Medical Corps, Health Promotion Board (HPB), SingHealth and other hospitals and private practices. They underwent one-day training and dry runs to learn how to don and doff PPE, and perform nasal swabs. Non-clinical staff from WHC also provided logistics and administration support to ensure smooth operations, and helped set up the subsequent halls.

NHGD DESIGNS SINGAPORE’S FIRST MOBILE X-RAY CABIN WITH NEGATIVE PRESSURE SYSTEM

NHGD, together with partners including TTSH and NCID, co-developed and project-managed Singapore’s first mobile X-ray cabin with built-in Negative Pressure System (NPS) in June 2020. Commissioned by Temasek Foundation and MOH, this cabin would serve as a design reference for future units. Designed to support efforts in managing the COVID-19 pandemic, the NPS contained airborne contaminants within the mobile X-ray cabin, while the HEPA filters installed at the airflow outlet ensured that only clean air was filtered out into the environment.

“It was a long, but fruitful week of preparation,” said Dr Wong Kirk Chuan, Chief Operating Officer of WHC, on the day the CCF@EXPO opened. “I’m very thankful for all the people who came together — doctors, nurses, operations, allied health, pharmacy, and external parties — and the extra hours and sleepless nights they had put in.”

Since then, all 10 halls at Singapore EXPO were retrofitted with a total capacity of 8,000 beds. Doctors and nurses worked 12-hour shifts as they managed triage and admission, conducted swab tests, and took patients’ vitals to monitor their condition. Patients who exhibited worsening symptoms were sent to hospital, while those who remained well two weeks after diagnosis and did not require further medical care were transferred to a step-down

Community Recovery Facility (CRF) to continue their isolation.

GOING DORM TO DORM

Around the same time that WHC was busy setting up the Singapore EXPO facility, an Inter-agency Task Force was assembled to handle the outbreak in migrant worker dorms. Led by the Ministry of Manpower (MOM), SAF and MOH, the Task Force deployed Forward Assurance and Support Teams (FAST) to assist dormitory operators in ensuring all aspects of residents’ well-being were taken care of. One of the first things FAST did was to establish medical posts in all purpose-built dormitories (PBDs).

NHG provided medical support for some 100,000 migrant workers in 14 PBDs in the north of Singapore. “The outbreak in dorms was a huge challenge,” said Dr Seet. “The population density within the dorms was very high, with up to 16 people sharing a room and relatively limited amenities. Some dorms had communal toilets and kitchens which, coupled with poor ventilation, contributed to the fast spread of the virus.”

The gravity and scale of the problem were not lost on the multi-agency partners, who sprang into action. SAF erected shelters and laid down the infrastructure. The Singapore Police Force (SPF) looked after the physical security and safety of healthcare workers. A large number of medical, nursing and administration staff from NHGP were deployed to the medical posts, augmented by staff from other NHG institutions, private healthcare groups and locums. NHGPH set up an on-site dispensary at each dormitory, with logistics and drug supply management support from the pharmacy team at Yishun Polyclinic.



ABOVE Senior Management and staff from NHGD with the Mobile X-ray vehicle at the Singapore EXPO.



ABOVE An NHGP doctor conducting a health check at a medical post within a migrant worker dormitory.

Associate Professor Steven Thng, Senior Consultant, NSC and Dr Mok Ying Jang, Deputy Chief Operation Officer, NHGP and team hit the ground running as they were assigned to conduct the reconnaissance, coordination and deployment of medical teams in all 14 dorms that were allocated to NHG. Together with the rest of the NHG team, they developed deployment protocols and SOPs from scratch, covering matters such as the rotation of personnel and biosafety considerations.

With everyone pitching in, the first medical post was operational within

three days, and all 14 sites were seeing patients within a week. The teams provided triage services and clinical care, and performed swab tests and looked into other important areas such as the mental health of the migrant workers and securing Specialist Outpatient Clinic appointments for those in need of specialty care. In addition, the teams worked closely with the ground deployment teams from SAF and SPF, and provided advice and training on PPE use. Dr Mok shared, "NHGP spared no effort in supporting this critical undertaking. Seeing the

“I am heartened by the incredible teamwork that I saw every day, across clusters, groups, and hospitals. Everyone, from the frontliners to those in support functions, was united and steadfast in caring for patients, stopping the spread of the coronavirus, and responding to this pandemic so selflessly and courageously.”

DR JASON CHEAH
DEPUTY GROUP CEO (TRANSFORMATION), NHG
& CEO, WOODLANDS HEALTH CAMPUS

BRIDGING LANGUAGE BARRIERS

At Singapore EXPO, the vast majority of COVID-19 cases were non-English-speaking migrant workers. To improve communication and ease their anxiety, WHC produced a video that translated common medical terms and questions into different languages such as Bengali, Tamil, Malay and Chinese. Another video showed rehabilitation exercises that they could do to stay active.

TTSH and NCID had a database of about 180 translators comprising staff and volunteers, created prior to the pandemic. Patient Admission Packages included QR code-linked FAQ videos explaining COVID-19 in migrant workers' mother tongues – such as Bengali, Tamil and Punjabi. TTSH set up a website, *VisualAid*, where healthcare professionals could download free illustrated cue cards, supplemented with Bengali translations, depicting commonly used phrases in healthcare settings.

smiles on their faces as they became better was something that kept the team going.”

“Migrant worker dorms were a blind spot for us initially, but through our deployment, I witnessed Singapore’s will and determination to make things right. While we might not be a perfect country, we were willing to acknowledge our deficiencies and we did our best to improve the situation,” said A/Prof Thng.

PULLING TOGETHER

Similar services were provided at the four resorts- and hotels-turned-Swab Isolation Facilities (SIFs) which NHG was assigned, with occupancy exceeding 1,100 beds. NHGP’s medical and administration staff formed the bulk of the SIF teams, alongside colleagues from NSC, TTSH and Yishun Health.

The SIF teams reviewed and assessed new admissions, conducted follow-up swab tests if needed, provided consultation for any health issues that arose during the patients’ stay at the SIFs, and scheduled those with chronic diseases and other issues for close monitoring. NHGPH supported this effort by running



ABOVE Staff packing medication for delivery to the COVID-19 frontlines.

on-site dispensaries and filling prescriptions for those taking chronic medications.

As part of increasing the nation's testing capacity, NHG conducted mass swabbing efforts at various locations around Singapore. Mr Darion Chong, Group Chief Corporate Development Officer and Group Chief Data Protection Officer, NHG; and Ms Tan Pek Hoon, Senior Nurse Manager from Yishun Polyclinic, NHGP, co-led and managed the mass swabbing operations. This was done in concert with other roving swabbers from TTSH, WHC and Yishun Health, who went around to various migrant workers dormitories and nursing homes that were linked to confirmed COVID-19



cases. "Mass swabbing was like a high-throughput activity, almost like a factory line," said Dr Seet. "At one site, the team completed more than 700 swabs in an hour and a half!"

The mental health needs of the public were not neglected, either. Both IMH and NHGP fielded some 105 psychologists, counsellors, medical social workers and psychiatrists to man the 24/7 National CARE Hotline (6202 6868), launched on 10 April. Together with other volunteers, they operated on shifts and provided psychological first aid and emotional support to callers who needed it. The initiative proved to be timely as more than 6,600 calls were made to the hotline just two weeks after it went into service.

"In a crisis like this, we needed to come together as one by taking care of those who had or were at most risk of falling prey to the disease. IMH contributed our doctors, nurses and allied health staff to the dormitories and the CCFs, and took care of the migrant workers' physical health. Our team also provided mental health input and support to the other doctors and healthcare professionals managing the migrant workers," added Professor Chua Hong Choon, Deputy Group CEO (Clinical) of NHG, and CEO of IMH.

Equally important in the COVID-19 battle was the health and safety

QUICK INSIGHTS

WHAT IS THE BIGGEST CHALLENGE ON THE GROUND AT THE MIGRANT WORKER DORMS?

A/Prof Steven Thng: Working in full PPE under the hot sun every day was, physically, one of the toughest hardships.

Dr Benjamin Seet: We provided refrigerators, air-cooled chillers and air-conditioned containers to make the heat more bearable. A/Prof Thng became an 'ice cream man', making frequent runs with his insulated box!

BOTH OF YOU HELD SENIOR POSITIONS IN THE SAF. DID THAT EXPERIENCE COME IN HANDY?

A/Prof Thng: Many of the SAF counterparts deployed to the dorms were familiar faces or my juniors. Because of my past working relationships with them, we had a good understanding of each other and how we worked, so things were able to move faster.

Dr Seet: None of my previous missions could compare with the scale and challenges of COVID-19. As a result, our operation was very fluid. We started off running medical posts but ended up running our own ambulance service as well, for example.

BESIDES OVERSEEING MEDICAL SUPPORT AT THE DORMITORIES, WHAT ELSE ARE YOU DOING TO FIGHT COVID-19?

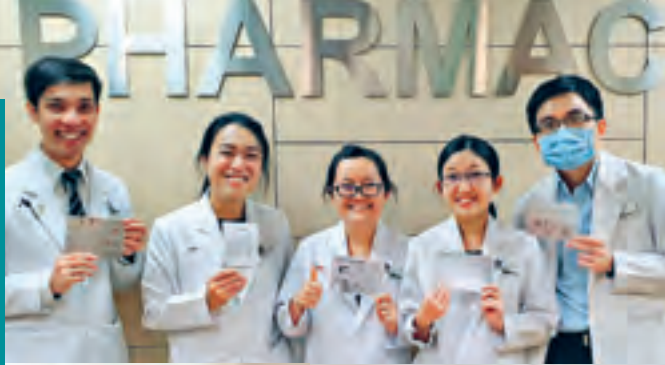
A/Prof Thng: I am part of a multi-agency task force that is studying how serology can be used to "exit" dorms into the community. We are designing serology study protocols to test our hypothesis on which dorms could be exited.

Dr Seet: I chair a panel that has been set up to ensure Singapore's access to COVID-19 vaccines and drugs, once available. I am also part of a multi-institutional R&D group that meets weekly to align R&D efforts across the island. In addition, we have re-engineered the Domain Specific Review Board process to expedite approval of COVID-19 proposals.

of people in the community. All six NHG polyclinics responded swiftly to put in place strict infection control processes to prevent and contain infection spread, and to protect staff and patients. These included ensuring safe distancing within the premises;



THANK YOU TO ALL FRONTLINERS



segregating patients into three different colour zones, depending on their risk of infection; and increasing the frequency of cleaning and disinfection. Staff were required to don appropriate PPE and adhere to staff surveillance systems.

In addition, NHGP also offered medication home delivery, deferred non-critical appointments and ramped up tele-consultations. This ensured the continuity of care for patients with chronic conditions while reducing the risk of COVID-19 transmission.

Ms Chan Soo Chung, Executive Director of NHGPh, said, "Since February, our pharmacies have received more requests for medication refills directly from patients. Additionally, NHGP doctors were proactively reviewing patients' case notes to identify those who were eligible for medication extension or tele-consultation. Medication delivery was arranged for eligible patients. The team had to quickly handle the surge in medication delivery-related issues."

To help in diagnosis and relieve the burden at NCID and the hospitals, all six NHG Polyclinics were conducting COVID-19 swab tests from February. NHGP completed about 6,000 swab tests between mid-February and 1 June.

"Many of our staff on the frontline worked tirelessly to contain the

“Singapore needs to sustain its public health capacity and capability. We need to have a rapid response team that can tackle potential epidemic waves in the future.”

PROFESSOR LEO YEE SIN

EXECUTIVE DIRECTOR, NATIONAL CENTRE FOR INFECTIOUS DISEASES

outbreak, be it at the polyclinics, or as part of teams deployed to provide medical support at the dormitories, SIFs, or mass swabbing missions. In knowingly putting themselves at risk to save lives and reduce the number of patients affected, they are our heroes. The strong team spirit and dedication demonstrated definitely brought us a long way during this tough period," said Associate Professor Chong Phui-Nah, CEO of NHGP and Primary Care.

EASING INTO THE NEW NORMAL

Reflecting on the first half of 2020, NHG's Group CEO Professor Philip Choo said, "This has been the toughest crisis ever faced in healthcare, and it has deeply impacted our nation and the world. The battle has not ended. The global scientific and medical institutes, including TTSH-NCID with giant collaborators, are searching very

EQUIPPING THE COMMUNITY

● **TTSH Community Swab Team**

In March 2020, TTSH established a community swab team to step up efforts to contain potential clusters at nursing homes and impede transmission of COVID-19. The TTSH Community Swab Team – comprising nurses, allied health professionals and administration staff – worked with nursing homes and home care providers in the Central Zone to train their staff to perform swab tests. In collaboration with KTPH, the team also conducted virtual training and on-site competency assessments to enable nursing home staff to conduct COVID-19 screenings at their workplaces.

● **NCID Nurses Advocate Infection Control**

The NCID nursing team trained staff at CCFs, SIFs, and private and community hospitals to equip them with the necessary skills to strengthen on-site infection control. This included donning and doffing of PPE, fitting of the N95 mask, training in infection control processes and hand hygiene, as well as nasopharyngeal, nasal and throat swabbing. The team conducted similar sessions for the Singapore Healthcare Corps, which involved some 80 volunteers so that they could, in turn, train some other 2,000 volunteers.

● **NCID Shared Best Practices With Community Care Providers**

In May 2020, NCID Training & Education Office collaborated with the Agency for Integrated Care (AIC) to organise two webinars on "Infection Prevention and Control and Clinical Guidance" for nursing homes and other community care providers. A similar webinar was held with the Ministry of Social and Family Development (MSF) for sheltered homes. Participants comprised nurses, infection control champions, physicians, General Practitioners (GPs) and Allied Health Professionals.



TOP TTSH medication delivery team processing patient orders.

hard for the panacea of vaccines and drugs for the long-term treatment and cure for COVID-19.”

One of the key challenges in developing such a vaccine is that the novel coronavirus which causes COVID-19 could mutate and drift. As Dr Shawn Vasoo, Clinical Director of NCID, explained: “We don’t yet know exactly which part of the virus we need to protect ourselves against. There are different approaches, and it remains to be seen which will be the most effective vaccine.”

While the hunt for a vaccine continues, other novel treatments are being explored, the NCID is leading the National COVID-19 Therapeutic Workgroup to evaluate how existing (re-purposed drugs) and novel therapeutics could be used to treat patients with COVID-19 infection. These include antivirals, immunomodulators, humoral therapies such as convalescent plasma and biologics, and vaccines. Chaired by Dr Vasoo, the workgroup comprises multi-disciplinary members from different institutions. It reviews available evidence as it emerges from trials conducted both locally and globally, and makes recommendations for therapy for COVID-19, which is constantly updated as new evidence emerges.

One promising treatment involves the use of convalescent plasma, collected from the blood of recovered patients teeming with antibodies. It has proven effective in small-scale studies to treat other infectious diseases such as SARS, and experts are hopeful that the same might be true for COVID-19. Dr Vasoo, who is leading the convalescent plasma programme at NCID, said, “Given the limited treatment options for COVID-19 and the limited but supportive data of its use, such as during SARS in 2003, we think that eligible patients might potentially benefit from such therapy and are thus setting up this programme.” As of 5 June, 20 recovered patients donated their blood, and five patients were treated with convalescent plasma.

On 10 June, Singapore’s Health Sciences Authority (HSA) granted conditional approval for



Gilead Sciences’ *Remdesivir* to be administered to COVID-19 patients who were severely ill. These patients included those with low oxygen saturation levels less than or equal to 94 per cent, or who required supplemental oxygen or more intensive breathing support, such as extracorporeal membrane oxygenation (ECMO) or invasive mechanical ventilation. Singapore was among the earliest countries to grant an approval for the medicine, which was previously available only through clinical trials. The MOH worked with NCID on developing guidelines for the appropriate use of the drug in healthcare institutions, and identifying patients likely to benefit most from this medicine.

Even after a successful vaccine or treatment is found and the world is able to rein in the coronavirus

pandemic, we should not be resting on our laurels. A pandemic could easily strike again in the future. That is why NCID, the National University of Singapore (NUS), and Nanyang Technological University (NTU) embarked on a research collaboration to study how various social and behavioural factors in the population are shaping, or are shaped by, the COVID-19 pandemic. Factors being explored include public perceptions about COVID-19 and their response to interventions by health authorities; the influence of mainstream and social media on public preparedness; the triggers for health-seeking behaviour; and the correlation between COVID-19 mitigation measures and social cohesion. One example is a cohort-based study launched by NCID in January 2020 to assess the population’s knowledge,

NATIONAL CONVALESCENT PLASMA PROGRAMME

NCID, together with the TTSH Department of Haematology, HSA and Duke-NUS Medical School, started a national convalescent plasma programme for the treatment of patients with COVID-19. It is led by Dr Mucheli Sadasiv, Associate Consultant, NCID, Associate Professor Ong Kiat Hoe, Head of Haematology, TTSH and Dr Shawn Vasoo. Under the programme, voluntary plasma donors who recovered from COVID-19 underwent stringent checks to ensure donated plasma was safe and carried sufficient quantities of COVID-19 antibodies. Through this initiative, efficacy of convalescent plasma treatment for COVID-19 was monitored and findings are expected to contribute critical insights to the management of the disease.



LEFT SIA cabin crew redeployed to become care ambassadors undergoing training at KTPH.

risk perception and behaviour during the COVID-19 outbreak. Some key initial findings of the SOCRATES (Strengthening Our Community's Resilience Against Threats from Emerging infections) study included high trust in the government's ability to handle the outbreak and towards official government communications. The study also revealed that the dominant source of false information the public and many respondents received came from social media.

"Understanding how the public

perceives and behaves during an outbreak and afterwards is a critical component of designing effective prevention strategies, allowing for better community engagement, and building greater resilience. The socio-behavioural studies resulting from the partnership between NCID, NUS and NTU would provide crucial evidence for better decision-making in countering the COVID-19 pandemic, as well as help us develop greater preparedness for the future," said Prof Leo.

SHOW OF SOLIDARITY

The community came together to thank healthcare workers on the frontline. Tokens of appreciation included heartfelt letters, flowers, snacks and artworks. Many also generously donated to The Courage Fund. Launched in 2003 during the SARS crisis, the Fund provides financial support and relief to vulnerable individuals and families affected by COVID-19. If you would like to make a contribution, visit comchest.sg/TheCourageFund.

LEVERAGING ON TECHNOLOGY TO TRAIN MEDICAL STUDENTS AND YOUNG DOCTORS AMID A PANDEMIC

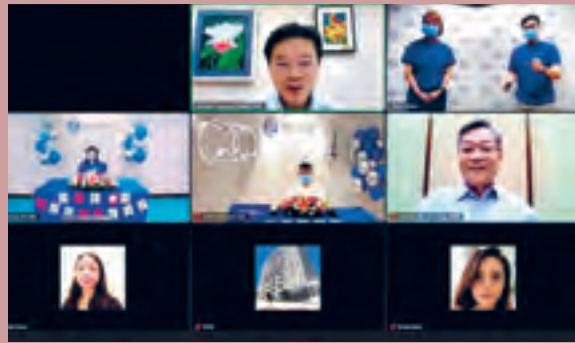
● During the COVID-19 outbreak, NHG educators who were faculty at Lee Kong Chian School Medicine (LKCMedicine) adapted clinical training to ensure students continued to receive robust education and meaningful learning experiences in a safe environment on campus and, later, at home. The training programme was re-evaluated during the onset of COVID-19 and clinical postings in the healthcare settings were converted to campus-based clinical training by leveraging on simulation and technology. *SimConsult*, a simulated clinic consultation session, was one such well-received innovation which was introduced for the Year 5 students' Student Assistantship Programme Family Medicine Posting. Simulating a polyclinic consultation at LKCMedicine's Clinical Sciences Building, students carried out consultations with simulated patients, who presented them with commonly seen complaints and conditions. These sessions were observed in real-time by NHGP Family Physicians via video conferencing, and in-depth feedback on communication and clinical management skills was subsequently provided to the students as part of their learning.

● With medical residents being deployed to the frontlines across Singapore to help combat COVID-19, NHG Residency took steps to minimise the disruption of clinical training, and, ensured the well-being of the residents and postgraduate year 1 (PGY1) doctors. "Zoom" was quickly adopted as a video conferencing platform for meetings and clinical training, which helped maintain continuity in their training.



NCID CELEBRATES FIRST ANNIVERSARY

On 7 September 2020, NCID celebrated its first anniversary. The virtual event was graced by Guests-of-Honour Mr Gan Kim Yong, Minister for Health, and Mr Lawrence Wong, Minister for Education, Co-chairs of Singapore's Multi-Ministry Taskforce tackling COVID-19. It was also attended by collaborators and supporters from public healthcare, academic and research institutions and NCID staff. MOH's Director for Medical Services, Associate Professor Kenneth Mak was invited to symbolically place a COVID-19 "brick" in NCID's time capsule – containing items that represent NCID being at the forefront of Singapore's battle against COVID-19 efforts.



FROM TOP (clockwise)
Zoom screenshot of Health Minister Gan Kim Yong and Education Minister Lawrence Wong gracing the virtual event.

A/Prof Kenneth Mak placing a COVID-19 "brick" into NCID's time capsule.

A/Prof Mak cutting NCID's first birthday cake.

“Never was the opening of a medical facility so timely and fortuitous, as NCID found itself at the forefront of our fight against COVID-19 just a few months later... This did not happen by chance. It was the result of years of planning and hard work by government agencies, medical and research institutions, and healthcare partners.”

PRIME MINISTER LEE HSIEN LOONG



FINDING A CURE AND VACCINE FOR COVID-19

Singapore is working with groups worldwide to ensure timely access to successful drugs and vaccines.

C COVID-19 arrived in Singapore on 23 January 2020. There are over 30,000 people here infected with the virus, while the global total has surpassed five million, with more than 330,000 deaths. One reason for the quick spread and high fatality is that this is a novel virus and anyone who encounters it would not have developed prior immunity. The elderly are particularly vulnerable, with high death rates observed in nursing homes in many parts of the world.

Public health and social distancing measures work to contain and limit the spread of the virus. However, to deal decisively with COVID-19, there is an urgent need for two items in the doctor's inventory. First, a vaccine to immunise enough people in the population to prevent further propagation of the virus. Second, an effective and safe cure to treat patients with serious illness and complications from the disease. As the SARS-CoV-2 virus that causes the disease was not previously known to doctors and scientists, both vaccine and cure do not exist today. It also does not help that it typically takes many years, sometimes up to a decade, to develop a new drug or vaccine.

In Singapore, we have strengths across our hospitals, universities and research institutes to study how the virus behaves and causes disease as well as how infected patients mount immune responses against it, and to develop new technologies to detect, track and neutralise the virus. When the outbreak of a new atypical pneumonia first emerged in Wuhan, China, the National Centre for Infectious Diseases (NCID) was quick to bring together experts from across Singapore to collectively tackle the challenges posed by this virus.

REPURPOSING EXISTING DRUGS

Developing a cure for a novel virus from scratch may take too long. So, the first approach was to find out if any existing drugs work against it. A re-purposed drug must have data to show its effectiveness in the laboratory and in animals, and an acceptable

safety profile. There were lessons that could be learnt from drugs tested against other coronaviruses that cause the severe acute respiratory syndrome and Middle East Respiratory Syndrome, as well as other infectious diseases. The NCID research group systematically combed the medical and scientific literature for potential drugs that could work against COVID-19. Early candidates were Chloroquine and Hydroxychloroquine, which are used to treat malaria and inflammatory diseases such as lupus and rheumatoid arthritis. While the early data was promising, this was subsequently shown to work poorly against the disease.

Another drug, Kaletra (lopinavir-ritonavir), was used against the human immunodeficiency virus that causes Aids. Our experience was that the drug had poor efficacy against COVID-19 and gave rise to many side effects. This was subsequently shown to be ineffective from clinical trials conducted in other countries. We also learnt of an experimental drug, Remdesivir, which was developed against Ebola. The company that developed it, Gilead, was planning to start clinical trials in the United States and other countries. Within four weeks of our first meeting with Gilead, NCID and other Singapore hospitals were able to start recruiting patients for clinical trials involving Remdesivir.

“In Singapore, we have strengths across our hospitals, universities, and research institutes to study how the virus behaves and causes disease as well as how infected patients mount immune responses against it, and to develop new technologies to detect, track, and neutralise the virus.”

This was facilitated by rapid approvals from medical, regulatory and ethics bodies here.

Singapore also participated in a multi-country trial led by the US National Institute of Allergy and Infectious Diseases (NIAID), which was important as it compared Remdesivir with a placebo. On 29 April, Dr Anthony Fauci, director of NIAID, announced that Remdesivir significantly improved recovery of COVID-19 patients.

What was amazing was the complete enrolment of 1,063 patients internationally in less than 60 days. While there had been a proliferation of more than 300 clinical trials for COVID-19, it was important for NCID to be very selective in evaluating which

ones to participate in. The evaluation had to consider the scientific and clinical evidence, as well as the design of the clinical trial. By working with Gilead and NIAID, Singapore was able to enrol close to 100 patients in the Remdesivir trials.

HARVESTING AND ENGINEERING ANTIBODIES

Another approach was to harvest antibodies from COVID-19 patients to treat others with the disease. This use of convalescent plasma has been shown to work in other serious virus infections. However, the quantity of antibodies that can be recovered is limited, and it would be challenging to produce enough quantities to treat more than a few individuals.

To overcome this limitation, a number of biotech companies established platforms to scale up the production of antibodies against COVID-19. One such company, Regeneron, produced an antibody cocktail that showed to be effective in the laboratory. Through an agreement with NCID, blood samples from recovered COVID-19 patients from Singapore contributed towards pre-clinical research and development of this cocktail. We also initiated talks for Singapore to potentially participate in clinical trials. A number of Singapore groups also joined the international race to develop monoclonal antibodies against COVID-19. Monoclonal antibodies are immune system proteins that are created in the laboratory. These include local





biotech company Tychan, as well as a partnership between the Agency for Science, Technology and Research's Singapore Immunology Network and pharmaceutical company Chugai.

Monoclonal antibodies can be specially designed and engineered to target the SARS-CoV-2 virus. The advantage is that these can be developed over several months, they can be produced in large batches and a single injection may last for a few weeks. There are plans for clinical trials to be conducted here and, if successful, the possibility to localise manufacturing as well.

DEVELOPING A VACCINE

Today, there are over 100 vaccine candidates being developed by biotech and pharmaceutical companies, some with the support of international coalitions. These include traditional vaccine technologies using inactivated or live attenuated viruses (which have been weakened or altered so they do not cause illness), which are time-consuming and require considerable resources to make. What is also exciting are nucleic acid vaccines (for example, RNA or DNA) synthesised using genetic materials from the virus.

With modern biotechnology, such vaccines can be manufactured in large quantities and, as they are generally required in only very small doses, provide an approach to producing the billions of doses required to vaccinate people around the world. While Singapore has limited expertise to develop its own COVID-19 vaccine, it has actively engaged leading vaccine groups and companies internationally.

The goals are for Singapore to participate in vaccine clinical trials, as well as to expedite regulatory review and approval for any successful vaccine. The Duke-NUS Medical School, for example, is working with Arcturus Therapeutics on its RNA vaccine, which has been shown to be highly effective in pre-clinical studies. Singapore has also registered to be a trial site for the World Health Organization's adaptive multi-country Solidarity vaccine trials.

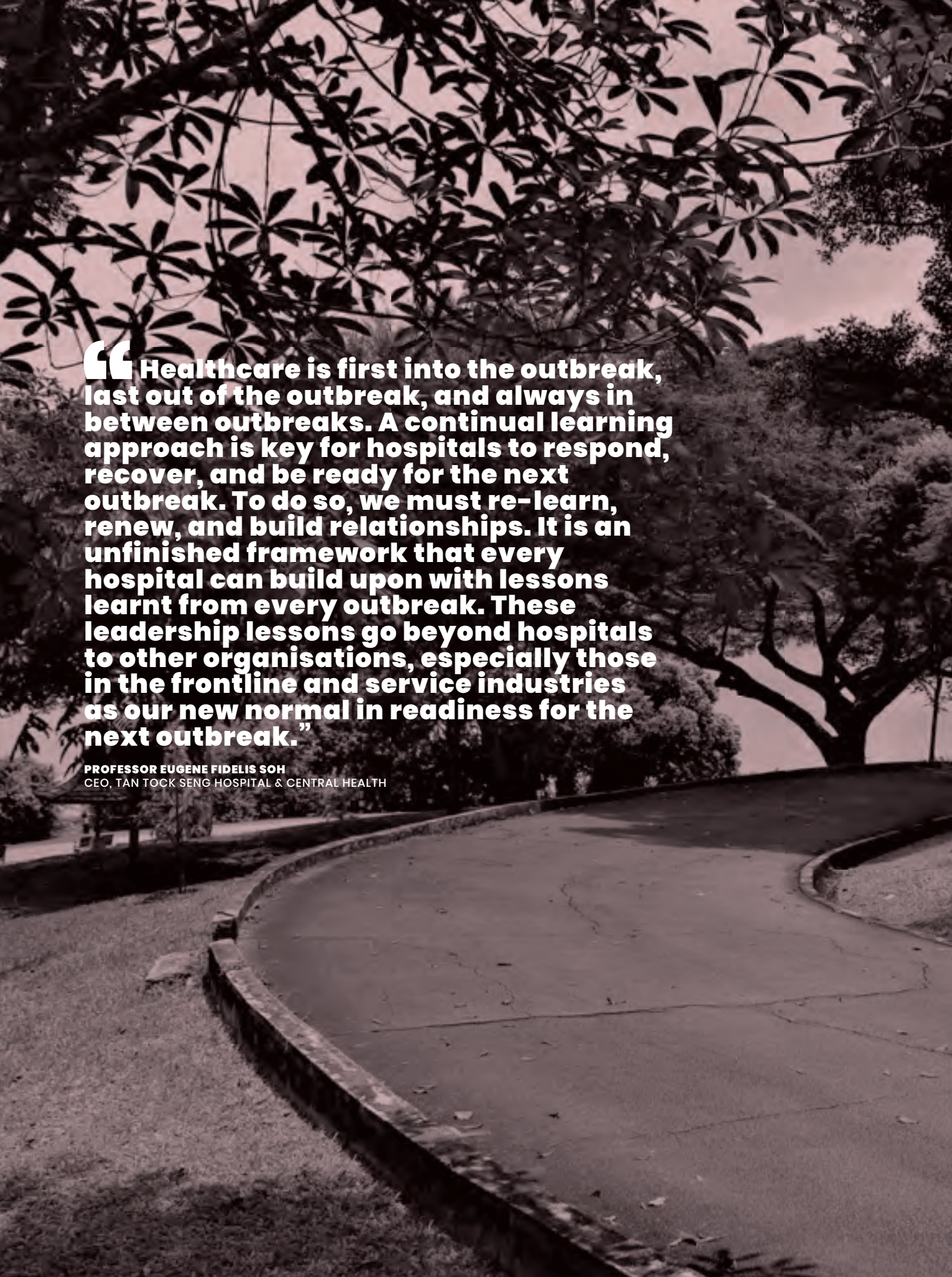
COVID-19 has caused societal and economic disruptions globally, and has taken a significant toll on human lives. Only a cure or treatment can bring an end to this pandemic. Singapore will continue to work closely with groups around the world in these efforts, and to ensure its timely access to successful drugs and vaccines.

By Associate Professor David Lye, Director, Infectious Disease Research and Training Office, National Centre for Infectious Diseases (NCID); Dr Benjamin Seet, Deputy Group CEO (Education & Research), NHG; and Professor Leo Yee Sin, Executive Director, NCID.

Source: The Straits Times © Singapore Press Holdings Limited. Reprinted with permission. Article first published on 23 May 2020.



“While Singapore has limited expertise to develop its own COVID-19 vaccine, it has actively engaged leading vaccine groups and companies internationally.”



“Healthcare is first into the outbreak, last out of the outbreak, and always in between outbreaks. A continual learning approach is key for hospitals to respond, recover, and be ready for the next outbreak. To do so, we must re-learn, renew, and build relationships. It is an unfinished framework that every hospital can build upon with lessons learnt from every outbreak. These leadership lessons go beyond hospitals to other organisations, especially those in the frontline and service industries as our new normal in readiness for the next outbreak.”

PROFESSOR EUGENE FIDELIS SOH
CEO, TAN TOCK SENG HOSPITAL & CENTRAL HEALTH

THE GLOBAL COVID-19 VACCINE RACE

Unprecedented speed seen in development efforts to produce first effective and safe vaccine.

The genome of SARS-CoV-2, the virus which causes COVID-19, was sequenced on 11 January, less than two months after the first cases of atypical pneumonia were reported in Wuhan, China.

Four months later, there are at least 130 vaccine candidates being developed by biotechnology and pharmaceutical companies, as well as academic groups globally. As of end-May, 10 experimental vaccines have entered into clinical trials, with the front runners planning to obtain emergency-use authorisation before the year end.

Chinese biopharmaceutical company CanSino Biologics was the first last month to publish human safety and immune response data for its vaccine candidate.

This tempo in development is unprecedented, as it could previously take up to 10 years or more to make a vaccine. In fact, the fastest any new vaccine had taken to obtain regulatory approval was five years, this being the Ervebo vaccine to prevent Ebola virus disease. These developments have triggered an intense international race to produce the first effective and safe vaccine for COVID-19, with some



governments taking early bets on prospective candidates.

The United States launched Operation Warp Speed to secure vaccines for its population. It has so far invested more than US\$2 billion (\$\$2.8 billion), including US\$1.2 billion to support a joint project between the University of Oxford and drug-maker AstraZeneca.

This could see the US receive 300 million doses of the vaccine as early as October, although there are no assurances that it will work. Pharmaceutical giants like Johnson & Johnson, Novartis, Merck and Pfizer have joined the race.

The announcement by Paris-based Sanofi, the world's third-largest vaccine producer, that the US has first rights to its vaccine provoked outrage across France, including from French President Emmanuel Macron. At the 73rd World Health Assembly last





“The ideal vaccine against COVID-19 should effectively trigger the immune system to prevent infection, be safe for use by the elderly and those with chronic diseases, have long-lasting effect, be manufactured quickly and inexpensively at large scale, and be easily stored and distributed.”

month, Chinese President Xi Jinping pledged to make China's coronavirus vaccines available globally.

THE VACCINE TECHNOLOGY LANDSCAPE

No single company or country is likely to meet the global demand for the

billions of doses of vaccine necessary to bring an end to the pandemic.

The ideal vaccine against COVID-19 should effectively trigger the immune system to prevent infection, be safe for use by the elderly and those with chronic diseases, have long-lasting effect, be manufactured quickly and

inexpensively at large scale, and be easily stored and distributed.

What is also very different for COVID-19 is the number of vaccine technologies that are being developed, including several that have never been licensed for clinical use. These include RNA and DNA vaccines, as well as viral vectors that carry genes encoding for coronavirus proteins. Traditional approaches make use of viruses that have been chemically inactivated or weakened. This has the advantage of being closest to an actual infection and results in a stronger immune response. There are, however, more side effects, including a potential concern that the antibodies produced may end up worsening the disease.

The manufacturing process is also well established, but as it involves growing the virus in animal cells, it can be time- and resource-intensive. This



further requires a factory with a high level of biosafety to handle live viruses.

With advances in molecular biology, new vaccine technologies have now been created. Nucleic acid sequencing has revealed the genetic blueprint of the coronavirus and allowed its protein composition to be decoded. This allows scientists to recreate and generate part of or the whole virus in the laboratory, as well as to develop new vaccine modalities. Nucleic acids like RNA and DNA can be manipulated in various ways, and manufactured quickly in large quantities. The challenge is that nucleic acids are less stable and not easily delivered on their own.

American biotechnology company Moderna, currently leading the pack, delivers its mRNA vaccine within a nano-sized lipid particle. Inovio, another front runner, delivers its DNA vaccine by electroporation, using a controlled electric pulse to inject the vaccine past the cell membrane.

A more elegant approach uses specially engineered and innocuous viral vectors, such as adenoviruses – a group of common viruses – to deliver the coronavirus genetic payload to the body's immune system. Adenoviruses are good at getting into cells and induce a strong immune response. They can also be allowed to replicate within the human host, providing longer-lasting immunity.

Another approach is to create vaccines using protein sub-units of the coronavirus. Such proteins can be synthesised in the laboratory using genetic material derived and modified from the coronavirus. They may be combined with molecules known as adjuvants, to boost the immune response at lower doses.

TAKING A VACCINE TO THE MARKET

Notwithstanding the initial optimism, and in spite of the latest knowledge and technologies, it could still take more than a year to deliver a

coronavirus vaccine to the masses.

The first step is to demonstrate that the new vaccine produces antibodies that can neutralise coronavirus in the laboratory. This is followed by a



challenge test, where live virus is introduced into a vaccinated animal to study its immune response and protective effect. Once scientists have enough data to be convinced that the virus is both safe and effective, clinical trials involving human subjects can begin.

In Phase One, healthy volunteers are injected with the trial vaccine to

assess its safety and immunogenicity – its ability to provoke an immune response. The aim is to find the right dose that elicits a strong immune response without causing serious side effects.

In Phase Two, hundreds of people are vaccinated and closely monitored to see if this protects them from the virus. This progresses to Phase Three,

where up to tens of thousands of people are vaccinated in a real-world setting, to see if vaccination reduces the risk of infection, compared with those who have not been vaccinated. The subjects are closely followed up with for any side effects. The industry experience is that about 90 per cent of vaccine projects do not go beyond this stage. If all the boxes are ticked,

HOW THE BODY FIGHTS OFF CORONAVIRUS INFECTION

CELLS ACTIVATED FOLLOWING VIRUS INFECTION OR VACCINATION:

Spike protein

Coronavirus spike protein binds to surface receptors on airway cells. This allows the virus to enter the cells. It replicates within and triggers release of chemicals that activate the immune system.

SARS-CoV-2 virus

Cell surface receptor

Chemical mediator

Neutralising antibodies

CELLS ACTIVATED FOLLOWING VIRUS INFECTION OR VACCINATION:

Plasma cells

Produce antibodies that attach to viral proteins, neutralising the virus.

T Helper-cells

Release chemicals that recruit and prime other immune cells against the virus. Another family of T-cells directly target and kill virus-infected cells.

Memory B-cells

Retain memory of their previous encounter with a virus. This allows them to trigger a more effective immune response when they come across the same virus again.

Dendritic cells

Detect and engulf infected and dead cells. They present virus antigens to T-cells, initiating the immune response.

POSSIBLE COVID-19 VACCINES COULD COME IN VARIOUS FORMS, BUT EACH IS DESIGNED TO TEACH THE IMMUNE SYSTEM HOW TO RECOGNISE AND FIGHT OFF THE VIRUS:



INACTIVATED VIRUS VACCINE

Whole virus that has been chemically inactivated, so that it can no longer cause the disease



LIVE ATTENUATED VACCINE

Weakened virus that causes mild infection, and tends to create a strong, long-lasting immune response



RECOMBINANT PROTEIN VACCINE

Specific pieces of the virus (for example, spike protein) that are synthesised in a laboratory, and that the body recognises as a virus infection. This is linked to an adjuvant, a molecule which helps boost the immune response



VIRAL VECTOR VACCINE

Adenovirus (a group of common viruses) or other virus engineered to carry selected coronavirus genes



DNA VACCINE

DNA plasmid, or ring, that encodes the coronavirus spike protein gene



RNA VACCINE

Lipid (fat) nanoparticle that encapsulates RNA encoding spike protein

ILLUSTRATIONS: DR BENJAMIN SEET

the company then seeks regulatory approval for a licence to market the vaccine.

At the same time, planning takes place to set up factories to manufacture hundreds of millions of doses of the vaccine under stringent conditions, and to package the final product in individual vials or syringes for shipment. The health authorities will then have to put in place a national COVID-19 immunisation programme, prioritising high-risk and vulnerable groups within the population to receive the vaccine first.

The programme will then need to be expanded to achieve herd immunity, where enough people in the population develop immunity to the virus such that it can no longer propagate and be transmitted. Assuming all this happens in time, there remains further questions that need to be addressed.

- Will a booster dose be needed to confer longer-lasting immunity?
- Will the virus mutate and make current vaccines less effective?
- Will enough people be convinced about the safety and efficacy of the vaccine to agree to be vaccinated?
- Will there be equitable distribution of vaccines between high- and low-income countries, and within each country?

With the race to make a COVID-19 vaccine elevated to the global stage, we are now witnesses to an interplay between science, biotechnology, public health, markets, governments and civil society. It remains to be seen how the pandemic will evolve, and what role a vaccine will eventually play in bringing it to an end.

By Dr Benjamin Seet, Deputy Group CEO (Education & Research), NHG and Professor Laurent Renia, Executive Director, Singapore Immunology Network, Agency for Science, Technology and Research.

Source: The Straits Times © Singapore Press Holdings Limited. Reprinted with permission. Article first published on 6 June 2020.

“With the race to make a COVID-19 vaccine elevated to the global stage, we are now witnesses to an interplay between science, biotechnology, public health, markets, governments, and civil society.”



ABOVE Staff practising safe distancing at the Ng Teng Fong Centre for Healthcare Innovation (CHI).



**THANK YOU MR EDWIN TONG,
DR AMY KHOR, DR LAM PIN MIN,
AND MR AMRIN AMIN FOR
WALKING THE JOURNEY WITH US**





KEEPING UP THE FIGHT

As the country comes to grips with a new normal, NHG is involved in a collaborative effort to help migrant workers recover from the coronavirus so that they can re-enter the workforce.

While Singapore has gradually reopened its economy in the wake of COVID-19, the crisis is far from over. The pandemic has affected the population at large, with 57,794 cases and 27 deaths recorded as of 2 October 2020, and with specific safety measures still in place. The country is also experiencing a severe economic downturn with business closures, job losses and rising unemployment. To-date, the Singapore Government has injected more than S\$100 billion from State Reserves to “save lives and livelihoods” affected by the pandemic.

It took a herculean effort to bring the outbreak under control

to a relative degree. On 7 April, the country went into a partial lockdown, or ‘Circuit Breaker’. At the direction of a specially-formed Joint Task Force (JTF) comprising public service officers from various organisations, NHG together with government agencies, dormitory operators, hospitality providers, social service organisations, and volunteers helped arrest the spread of the coronavirus and brought down the active caseload. As migrant workers made up more than 90 per cent of local COVID-19 cases, curbing transmission within the dormitories required endurance and commitment. As the Circuit Breaker came to an end on 1 June, NHG shifted gear to focus on two priorities: (i) returning migrant

workers to essential services; and (ii) handing over management of the Swab Isolation Facilities (SIFs) and dormitories to public- and private-sector partners.

ON THE GROUND

The contribution of migrant workers to Singapore’s economic growth is immense. The construction, marine shipyard, process, and manufacturing sectors rely heavily on such labour. Hence, as Singapore prepared to exit the Circuit Breaker and restart the economy, one of the most pressing matters was to clear all 323,000 migrant workers living in dormitories of COVID-19 so that they could resume work — starting with those involved in critical infrastructure projects and maintenance/repair activities.

A crucial factor that expedited their return to work was the quality of medical support such workers received while in their dormitories or community care facilities (CCFs). NHG — which was assigned 14 purpose-built dormitories (PBDs) and four resorts- or hotels-turned-SIFs — worked closely with multiple partners to provide care for the migrant workers’ health and well-being.

“The experience made me take infection control practices

very seriously. It was imperative that the correct migrant workers were brought out at the right time and assigned to the appropriate sections within the medical post to prevent cross-infection,” said Ms Siti Rasyidah, an assistant nurse clinician from Hougang Polyclinic who was deployed to an SIF. As for Ms Vithya Govindasamy, a pharmacy technician at Yishun Polyclinic, she noted that her linguistic abilities were put to good use at the dormitories. “I was able to speak Tamil, as well as basic Hindi and Chinese to the migrant workers and offered them a listening ear. Together with my colleagues, I was glad to help them tide over the difficulties they faced.”

While frontline staff worked tirelessly on the ground, centralised planning and coordination helped NHG adapt to surges in demand and unexpected situations. “Regular planning and coordination meetings were held daily at the start of dorm operations, and weekly after the situation stabilised. These ‘Zoom’ sessions allowed regular updates of the dorm situation and status of operations, as well as joint planning for the next steps,” said Dr Benjamin Seet, who was overseeing the NHG efforts. By the time the “next step” of releasing migrant workers back into the essential workforce arrived, NHG had a plan for that, too.

BACK TO WORK

For migrant workers to resume work, it was first vital to establish that they had either fully recovered from COVID-19 or tested negative for the virus. Two strategies were adopted by NHG:

- In dormitories with high case numbers, all migrant workers underwent serology (antibody) tests. If antibodies were detected, it meant that they were infected before and had developed immunity against COVID-19 and were unlikely to be infected again – and so were well enough to be released back to work.
- In dormitories with low case numbers, all migrant workers were swabbed in groups. Those shown not to carry the virus were isolated for a further 14 days, after which they could go back to work if they remained asymptomatic and passed a second swab test.

A/Prof Steven Thng, who spearheaded the phlebotomy (blood draw) programme for COVID-19 serological testing, said, “The phlebotomy team was trained in PPE requirements and venepuncture (collection of blood from a vein). We set out our goals that there should be no needle stick injuries and no staff should go down with COVID-19 at the end of this deployment.” The latter was achieved as not one

SINGAPORE’S EXIT STRATEGY

Currently in Phase 2, Singapore has adopted a ‘safety first’ approach to reopening the economy and society:

Phase 1: Safe Re-opening (from 2 June)

- Businesses that do not pose a high risk of transmission reopen with safe management measures.
- People leave home only for essential activities.

Phase 2: Safe Transition (from 19 June)

- More businesses reopen with safe management measures.
- All students fully return to school.
- Sporting and recreational facilities reopen with safe management measures.

Phase 3: Safe Nation (end-2020 as announced by the Multi-Ministry Taskforce for COVID-19)

- Gatherings and events resume with limited crowd sizes.

NHG staff was diagnosed with COVID-19 in the line of duty.

The key challenge facing his team was in those dormitories not at either extreme end of high or low COVID-19 prevalence. “In these dorms, 50 per cent of migrant workers were infected and protected, while the other 50 per cent were still immunologically naïve and thus susceptible to infection. It was hard to move the migrant workers around to ensure that they could be cleared for work,” said A/Prof Thng.

NHG also joined forces with other agencies to form mass swabbing teams that went around Singapore, including to migrant worker dormitories.

“Rather than seeing large swab tasks as a burden, we saw them as a challenge. The completion of each task reinforced the camaraderie and confidence within the team,” said Mr Darion Chong, Group Chief Corporate Development Officer and Group Chief Data Protection Officer at NHG. For example, as the team became more adept at donning and doffing PPE, as well as performing the correct swabbing technique, they looked for other ways to improve operations,



ABOVE A/Prof Steven Thng, Senior Consultant, NSC attending to migrant workers.



such as sheltering migrant workers from having to wait in the hot sun.

Despite the tough conditions, having a common purpose kept everyone’s morale high. As A/Prof Thng noted, “Everyone understood that they were, in their own little way, contributing to Singapore’s reopening as well as the migrant workers’ well-being. This brought meaning to their work and motivated them to work hard, even on weekends and public holidays.” Giving staff rest days, sharing snacks, and celebrating small achievements along the way also helped, like when the serology team held a ‘durian party’ after it had hit the milestone of 40,000 tests conducted earlier than expected.

FIGHTING FIT

Clearing migrant workers of the coronavirus was, of course, the primary concern in enabling their return to work. But it was not the only one. Throughout their deployment, NHG staff cared for all aspects of the workers’ well-being, virus-related or otherwise.

As COVID-19 cases fell gradually, and the number of migrant workers showing respiratory symptoms decreased, a rise in workers presenting with musculoskeletal, skin and chronic illnesses was observed. Dr Darren Seah, Family Physician, Senior Consultant and Director of Family Medicine Development at NHGP, who

was responsible for formulating the medical protocols and workflows at the dormitory medical posts, therefore, had to update these accordingly.

For example, blood test support was added for patients requiring chronic care. “The requirement to provide basic blood test capability at our medical posts required support from multiple stakeholders within the NHG family — from KTPH supporting the laboratory function, and NHGD providing technical details of phlebotomy equipment, to NHG HQ Finance providing contracting support for sample conveyance, and ALPS — the national integrated

healthcare supply chain agency — procuring the equipment on short notice,” said Dr Seah.

It was also vital for migrant workers to be up to the physical demands of their jobs, which typically involved heavy manual labour. “Due to the prolonged period without work and quarantine in the dormitories, many developed musculoskeletal problems, became deconditioned, overweight or obese, or sustained injuries due to exercising in the bunks,” explained Dr Pan Jiun Yit, an NSC Senior Consultant who led a medical post and on-site CCF at one of the dormitories. “The physiotherapy staff in my team took the initiative to perform a thorough assessment of the patients and taught them physiotherapy and stretching exercises. This helped them return to work safely.”

Mindful that such prolonged isolation could cause emotional or psychological distress, NHG staff paid special attention to the migrant workers’ mental health as well. “We collaborated with community partners such as HealthServe to give educational materials and provided counselling and helplines to migrant workers in need,” said Dr Tung Yew Cheong, Family Physician, Senior Consultant and Director of Quality and Patient Safety at NHGP, and lead for SIFs. “Daily phone calls and ‘corridor health check rounds’ provided opportunities for the teams

PASSING THE TEST

While NHG concluded its operations in the dormitories and SIFs in July, WHC continued to handle the CCF operations @ Singapore EXPO, only handing over to the Raffles Medical Group in September. One partner at the EXPO was NHGD, which deployed a team of radiographers to perform on-site X-ray examinations for patients aboard a Mobile X-Ray trailer. While doing so, the radiographers also assisted in alleviating their fears. “Because migrant workers were confined to the EXPO, sometimes X-rays were the only opportunities they had to interact with others,” said Mr Christopher Ong, a Senior Radiographer at NHGD leading the team. “I could sense that they appreciated how we took time to talk to them and learnt how they were feeling.”

The experience was also a bonding opportunity for WHC staff, many of whom are spread out at different hospitals in their business-as-usual roles. “It felt like we were long-lost friends striving for a common cause. It was exciting to work closely together and bond with one another before the completion of our campus,” said Mr Jeremiah Loh, a Senior Nurse Clinician at WHC, who was nested in Yishun Community Hospital prior to the crisis.

Dr Jason Cheah, Deputy Group CEO (Transformation), NHG, and CEO, WHC, agreed, “Setting up CCF @ EXPO was the first major test for WHC in terms of coming together to create and make something happen. The fact that we pulled it off proved that we could do something together that was meaningful to the public and an important contribution to the country. It put us in a better state of mind to prepare for our new hospital.”

“Everyone understood that they were, in their own little way, contributing to Singapore’s reopening as well as the migrant workers’ well-being. This brought meaning to their work and motivated them to work hard, even on weekends and public holidays.”

ASSOCIATE PROFESSOR STEVEN THNG
SENIOR CONSULTANT, NATIONAL SKIN CENTRE

to identify and flag out migrant workers who could have mental health-related issues.”

Frontline staff even came to migrant workers’ aid on non-medical issues such as providing smartphone chargers, and nail clippers, and surprising them with birthday treats. As Ms Rae Wong, a staff nurse at the Institute of Mental Health (IMH), recalled during her SIF deployment: “Our weekend doctor had the ingenious idea of bringing electric hair trimmers for the migrant workers to cut their hair and beards, so that they would look more presentable when they headed back to work. By doing so, he maintained their dignity and facilitated a faster transition to work.”

A SMOOTH TRANSITION

NHG’s close partnership with private healthcare groups was crucial

in its effective management of the coronavirus outbreak at the dormitories. With the situation improving in Singapore, NHG stood down after about three months of managing the four SIFs, which were converted to Government Quarantine Facilities (GQFs) in early July. As part of the transitioning for care arrangements, NHG also handed over the medical support management of the 14 dormitories to two healthcare providers, Fullerton Health and SATA CommHealth, on 23 July.

“During this transition phase, NHG’s SIF administration and medical teams worked closely with the JTF and MOH to make the necessary discharge and continuity of care plans for migrant workers in the SIFs,” said Dr Tung. The staff drew up a comprehensive plan covering the decommissioning of infrastructure, such as tentages and

RETURNING TO BUSINESS AS USUAL

With the number of COVID-19 patients slowly but steadily decreasing and those who require acute hospitalisation easing, hospitals in Singapore are cautiously going back to its business-as-usual operations. Wards and beds which were previously set aside for such patients were disinfected and converted back into regular ones for non-COVID-19 patients. These can be converted back to care for COVID-19 patients if required. Services that were previously suspended are resuming in a “phased manner”, with the services prioritised based on medical urgency, said MOH. “Services that can be provided using teleconsultation should continue doing so, to minimise the need for face-to-face consultation.”

At TTSH, all business-as-usual services are progressively restarting, and staff who had been retrained for COVID-19 duties are gradually being rotated back to their original roles. Associate Professor Chin Jing Jih, Chairman Medical Board, TTSH and Central Health, said, “The resumption of services will be prioritised and phased accordingly in a controlled manner, while still maintaining and managing the outbreak support at NCID and in the community.” Alongside the resumption of hospital operations, TTSH has continued to maintain measures to keep its staff and patients safe. These include continuing hospital surveillance, strict infection control and enhanced cleaning routines.

air coolers, at the SIF medical posts; transporting the medical equipment, medication and administration materials back to the polyclinics; manpower re-allocation of the SIF teams; and archival of medical data and records.

Likewise at the dormitories, handover plans covered all aspects of medical post management including deployment sites, transport, logistics, manpower requirements, and reporting channels. “As NHG was working hand-in-hand with Fullerton Health and SATA CommHealth since the start of dorm operations, and had a good working relationship with both groups, the transition was very smooth and was completed within one week,” said Dr Seet.



ABOVE Setting up a medical post at Kranji Lodge 1.



ABOVE WHC staff gearing up at the CCF @ Singapore Expo.

Medical support for the dormitories changed hands once more in September, when the Ministry of Manpower (MOM) took over operations from the two private vendors. The Ministry of National Development (MND) now oversees the running of the GQFs by the resort and hotel management teams, while HPB does all mass swab testing, though NHG and other public healthcare institutions still maintain a small team on standby for contingencies.

NHG staff deployment to the frontlines may have ended, but the lessons learnt will live long in their memory. Mr Caleb Chong from NSC, an administration team lead at an SIF, shared, "My conversations with migrant workers made me more grateful and appreciative of their contributions to Singapore's economy. Whether in peacetime or during a pandemic, we should always serve with a heart and treat patients, including migrant workers, with empathy and compassion."

A LONG BATTLE

On 19 August, MOM declared that all migrant worker dormitories — including the standalone blocks in PBDs serving as isolation or quarantine facilities — were cleared of COVID-19. This paved the way for the vast majority of migrant workers to resume work, as more sectors and businesses were permitted to safely restart operations.

However, the finishing line is still not reached. Fresh cases have emerged in

“When SARS hit Singapore and TTSH was declared SARS-central in early 2003, the health system was tremendously stressed. Today, we are much better prepared. For one, the NCID has been purpose-built to handle such outbreaks. The infrastructure and equipment are in place. The people running the place have had the experience of past outbreaks. And they are still with us. We have been resilient in the past. And we will prove this again as we stand united in doing what we must for the good of Singapore.”

PROFESSOR CHEE YAM CHENG

SENIOR ADVISOR, NHG & PRESIDENT, SINGAPORE MEDICAL COUNCIL

some previously-cleared dormitories, which underline the difficulty in stamping out the virus. On-going measures such as fortnightly routine testing of migrant workers, fast contact tracing, Stay-Home Notices and Quarantine Orders, and self-monitoring of workers' health via the MOM app are necessary to enable early detection and prevent large clusters from forming.


Also necessary is the mindset of prudence and perseverance.

“We cannot look at COVID-19 through Singapore lens alone. As we open our borders and economy, new cases will be introduced and new outbreaks will occur. We cannot project where and when they will occur, but will need to remain vigilant to detect and contain them quickly,” said Dr Seet. “It is only when an effective vaccine becomes available, and only after mass vaccination of the population takes place, that we will have the confidence to say that the worst is over.”

GIVING THE GREEN LIGHT

Besides testing all migrant workers to confirm they were free of COVID-19, a number of other requirements also had to be fulfilled before the MOM granted approval for their work resumption:

- Dormitory operators had to implement safe living measures (e.g. no inter-mixing, and safe distancing within dorm premises), and staggered pick-up and drop-off times for workers with their employers.
- Employers had to introduce safe management measures in the workplace (e.g. use of face masks and the SafeEntry digital check-in system), and update their workers' residential addresses in the MOM database.
- Migrant workers had to download three different mobile apps — FWMOMCare, to monitor and report their health status daily; TraceTogether for contact tracing; and SGWorkPass to check their AccessCode status. An AccessCode Green status meant that all of these criteria had been met, and workers could leave their dormitories to go to work.



“ Every crisis teaches us new lessons. NHG has done well to learn from previous outbreaks, which has helped us greatly in managing the COVID-19 pandemic. The best way to gird ourselves for any potential future crisis is to be always prepared, to be always mindful, and expect the worst. This is something which I think is ingrained in our DNA at NHG.”

DR JASON CHEAH
DEPUTY GROUP CEO (TRANSFORMATION), NHG
& CEO, WOODLANDS HEALTH CAMPUS

MANAGING COVID-19 @ GROUND ZERO

The Tan Tock Seng Hospital (TTSH) outbreak management framework is a continual work in progress; building upon lessons learnt from every outbreak. These leadership lessons go beyond hospitals to other organisations, especially those in the frontline and service industries. Professor Eugene Fidelis Soh, CEO, TTSH and Central Health, shares how TTSH, in partnership with NCID, responded to the COVID-19 pandemic at Ground Zero and transits to a new state of readiness for any outbreak.

On 2 January 2020, Tan Tock Seng Hospital (TTSH) started screening patients, who showed up at the Emergency Department (ED) with fever and symptoms of acute respiratory infection (ARI), for the disease we now know as COVID-19.

Then, reports were coming out of China describing a novel coronavirus, and TTSH began actively looking for cases who came to the ED with a history of travel in Wuhan, coupled with symptoms of ARI.

This was Singapore healthcare's very first step in what was to become its outbreak response, a period that marked the Emerging Phase of the outbreak at TTSH as the hospital prepared for this new threat.

In those early days, a test kit was already being developed, in anticipation that reliable testing would be key in confirming diagnosis. Called Fortitude, the Polymerase Chain Reaction (PCR) test kit was developed by TTSH's Department of Laboratory Medicine together with the Agency for Science, Technology and Research (A*STAR). It also ensured that Singapore had a reliable local supply of test kits.



ABOVE Prof Eugene Soh, CEO, TTSH & Central Health (right); and A/Prof Chin Jing Jih, CMB, TTSH & Central Health, wearing full PPE while visiting an outbreak ward at TTSH.



LEFT Prof Soh and A/Prof Chin visiting the converted outbreak wards at TTSH's main building to thank staff for their diligence and sacrifice.

“TTSH had to reduce its Business-as-Usual (BAU) operations to make available manpower and resources for its COVID-19 response. Arrangements were made to quickly triage clinic appointments and postpone elective and non-urgent cases.”

Suspect cases then were tested at TTSH ED and conveyed to the National Centre for Infectious Diseases (NCID) across the road for isolation. This was done via a specially designed double-deck bridge connecting the two buildings. Laboratory testing using PCR analysis by the National Public Health Laboratory (NPHL) was subsequently transferred to TTSH's Department of Laboratory Medicine (DLM) to better support and scale up clinical testing capacity to 24/7 for NCID and TTSH. (Today, testing for COVID-19 is done across public and private laboratories in support of efforts to contain the outbreak.)

On 22 January, the Ministry of Health (MOH) declared Disease Outbreak Response System Condition

(DORSCON) Yellow. The next day, Singapore's first imported COVID-19 case was confirmed at the Singapore General Hospital, on 23 January.

The day after, the country's second imported case was confirmed at NCID.

TTSH and NCID immediately moved into the Containment Phase of the outbreak, focusing on efficient screening and isolation.

By 27 January, three contingency outbreak wards at NCID were opened to provide isolation beds for suspect and confirmed cases.

With numbers expected to rise, the hospital set up its Integrated Operations Coordinating Platform (IOCP) comprising leadership across TTSH and NCID, and started joint command operations.

28 January was set as the date to kick off TTSH's augmentation for the outbreak response at NCID – that is D-Day in the hospital's Outbreak Disease Preparedness Plan.

To do this, TTSH had to reduce its Business-as-Usual (BAU) operations to make available manpower and resources for its COVID-19 response. Arrangements were made to quickly triage clinic appointments and postpone elective and non-urgent cases. Non-COVID-19 patients warded at NCID needed to be moved to TTSH so that the vacated wards could be readied to hold COVID-19 patients.

Upon 24-hours activation, TTSH ED transferred COVID-19 screening operations across the road to the purpose-built Screening Centre at NCID. 1,266 staff were transferred from the main hospital to augment the 687-strong NCID and ramp up NCID's capacity, and open a 24/7 Screening Centre.

Ten days from D-Day activation, this Phase 1 ramp-up of NCID, from 150 to 330 operational beds was completed, by 7 February, just as MOH declared DORSCON Orange.

During the SARS outbreak in 2003, TTSH was locked down and designated the SARS hospital. That experience shaped the hospital's planning and development of NCID to become Singapore's vanguard against infectious diseases. NCID, officially opened on 7 September 2019, merely months before COVID-19 landed in Singapore, was ready just in time.

With the understanding that no two outbreaks were identical, a contingency had been built into NCID by design to be able to increase beds up to 586 with ready-oxygen points. On 15 March, MOH approved TTSH's further augmentation plan to increase NCID's total beds from 330 to 586 beds.

This Phase 2 ramp-up saw an additional 422 staff being deployed to NCID. This brought the total headcount deployed from TTSH to NCID, to 1,688 staff in Phase 1 and 2, including 107 staff



LEFT Prof Soh and A/Prof Chin visiting the former Communicable Disease Centre (CDC), where teams had soldiered on over the Labour Day weekend to ready the old wards as a Pre-Community Care Facility.

seconded from other public health institutions.

As the COVID-19 outbreak began to worsen after March, TTSH moved into a third phase, significantly scaling up its COVID-19 capacity beyond NCID.

On 14 April, TTSH opened its first overflow COVID-19 ward back at the main hospital. At peak capacity in the middle of May, some 1,475 beds were operationalised for COVID-19 across the TTSH campus. This was on top of operating 729 beds for TTSH's BAU patients then.

During the outbreak, TTSH and NCID were managing about 50 to 70 per cent of the national workload for COVID-19 patients who required hospital care. As of 1 June, we had screened more than 30,000 and admitted more than 9,000 patients for isolation and treatment.

Today, Singapore has come out of the Circuit Breaker Period, and so begins a slow and carefully calibrated transition to the Recovery Phase of the outbreak for Singapore.

As a result of the collective efforts of the whole community to flatten the curve, healthcare capacity has been

safely conserved, especially with the massive opening of community care facilities for recovering COVID-19 patients. This recovery phase has been called a dance with the need to calibrate the resumption of hospital services versus our continuing vigilance to respond to any resurgence of cases in the community. It will be prolonged as we strive to keep the curve flat, transit to a new normal, and await the development of a vaccine for establishing herd immunity.

WHAT WE LEARNT IN OUTBREAK MANAGEMENT

At TTSH, we learn that outbreak management at the hospital level has to be nimble; to quickly take on various postures and effectively tackle the fast-evolving situation, in tandem with public health efforts at each phase of the outbreak.

We have to be ready, respond, and recover, only to be ready again. Here, we outline key leadership considerations in a Hospital Outbreak Management (HOM) Framework.

State of Response

In the thick of the outbreak response at Ground Zero, there are five key leadership considerations.

Safety: Protect our healthcare workers so that they will protect one another and their families, and keep our patients safe. The key to

“At TTSH, we learn that outbreak management at the hospital level has to be nimble; to quickly take on various postures and effectively tackle the fast-evolving situation, in tandem with public health efforts at each phase of the outbreak.”

safety is strong infection control and prevention. It starts with universal precautions, hand-washing and the appropriate Personal Protective Equipment (PPE) for each role and location.

Safety is also achieved by design, with facilities planning for the segregation of staff and patient flows, and clean and dirty flows. Negative pressure rooms with areas for donning and doffing PPEs need to be provisioned. Safety is also a culture. From voluntary incident reporting to quality assurances, it allows for continual improvements with psychological safety and a just culture for those involved.

Systems: Taking a systems approach to support ground operations enables a concerted hospital-wide response. A Command, Control and Communications (C3) system was recently commissioned at the 24/7 TTSH Operations Command Centre. It provides real-time visibility of patient flow and resource management. The C3 system is a game changer, with the ability and agility to scale an outbreak response from a single hospital to a national strategy across hospitals.

Scalability: This is essential for the hospital to switch from “peacetime” mode to “outbreak” mode in as short a time as possible, and scale accordingly to the fast-evolving situation. It pertains to three key aspects – capacity (such as beds), capability (such as lab testing) and manpower. Scalability allows the outbreak response to be titrated one step ahead of the situation so as to respond effectively, but not too far ahead such that there is disconnect with reality on the ground. It enables the hospital to manage peaks and troughs in demand, and rest manpower in between peaks. It also allows for capacity to be balanced between BAU and outbreak response. This was a key factor in planning for NCID to be integrated with TTSH for a full outbreak response; for capacities, capabilities, and manpower to be supported by the main hospital in a scalable way.

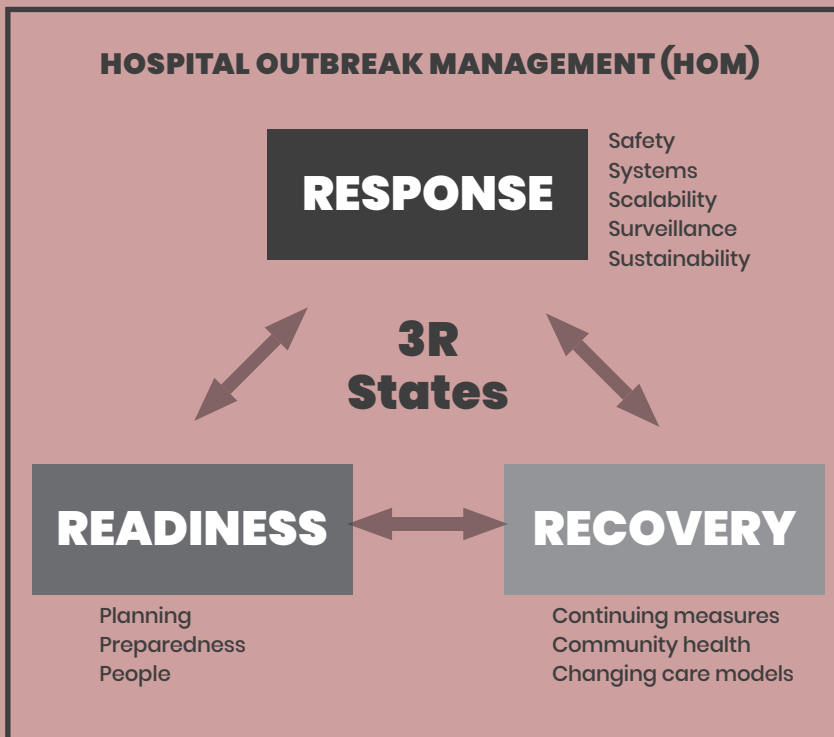
Surveillance: While watching the front door during an outbreak, the hospital must keep an eye on the back door, as there is always the risk that hospital staff and BAU patients could bring in the infection from



the community. TTSH’s Department of Clinical Epidemiology oversees hospital surveillance. Doing “sweeps” across the hospital at the beginning of an outbreak is key to the containment strategy prior to commencing screening of new admissions and visitors into the hospital. High-risk patients who may present for other conditions are identified for their susceptibility and actively isolated for treatment and safety. Staff surveillance, covering sickness, twice-daily temperature monitoring, and staff movement, is reinforced to facilitate efficiently any hospital-based contact tracing. Technologies used range from the simple to the sophisticated; from Staff Roll Calls to Real-time Location Tracking Systems (RTLs); from Closed Circuit Televisions (CCTVs) to Video Analytics. All these are integrated into the C3 at the hospital’s Operations Command Centre.

Sustainability: This is a key consideration for manning, especially with a prolonged outbreak situation. The hospital needs to last the fight and not exhaust its workforce before the battle ends; there are peaks and troughs to contend with throughout. Measures to preserve the workforce include reducing non-essential activities, managing staff leave and redeploying staff.

Communications and engagement are challenging in a big hospital with more than 10,000 staff and even more so with this outbreak’s



critical need for safe distancing. TTSH has taken engagement online with its intranet as a single source of truth for all updates and revisions to hospital policies. TTSH's Kampung Online Application, utilising Workplace from Facebook, is the key engagement platform for team discussions and timely updates anytime anywhere. Other technologies adopted include secure messaging, chat bots, teleconferencing, and micro-learning applications.

Last but not least, equity issues do arise among groups of staff, pertaining to support, training and work schedules. Mindful that the constant heightened vigilance and increased workload may lead to both physical and mental fatigue of staff, Staff Support Staff (3S) programmes have been ramped up to focus on staff's mental well-being and welfare.

Besides the hotline, there are energising campaigns like #HealthcareHeroes and #SpreadASmile to encourage and recognise staff for their efforts. A Kampung market was also set up to share in-kind donations and goodwill by our community, especially for lower-income staff.

Enhanced staff policies were introduced to address issues from alternative accommodation to safe management practices. Titrated leave management ensured that as many staff as possible could take turns to rest.

State of Recovery

As Singapore moves to a post-Circuit Breaker period, the hospital too has to prepare for its road to recovery. However, BAU will not be the same as before. The road to recovery from a crisis goes beyond the opportunity to re-group and re-charge. It is important the focus of recovery is ultimately on the renewal of the organisation and its workforce towards the new normal that lies ahead.

Continuing measures: We need to continue to keep the curve flat. Measures include robust healthcare actions from testing to contact tracing to containment of any resurgence of cases; new habits such as mask-wearing, eating alone in pantries and safe distancing at the hospital and during commute to and from home; and raised hygiene measures at the workplace and in the community.

For the hospital, continuing hospital surveillance, strict infection control and enhanced cleaning routines will be the new normal. The hospital has adopted new technologies like machines with ultraviolet and hydrogen peroxide disinfection capabilities to assist in terminal cleaning and to keep our cleaners safe in doing so.

Community health: A population health and systems approach ensures a full recovery from the outbreak and resilience for the next. There are three aspects: vaccinations to create herd immunity, vulnerable populations that need added protection (e.g. those living in communal settings, elderly), and vigilant public health intelligence.

The hospital supports mass testing and mass vaccinations in the community, prioritising vulnerable populations. Vaccinations against other viruses like influenza also play a part to reduce the "noise" of ARI symptoms in the community. Working closely with our community care partners, the hospital helps to train staff and ensure that vulnerable populations in nursing homes are kept safe. The hospital is also a key safety net to catch the index case of a potential cluster in the community and support contact tracing and testing for close contacts.

Changing care models: We must incorporate lessons learnt during the outbreak to future care models to build up our healthcare resilience. During this outbreak, TTSH kept one-third of its beds and clinics for BAU operations to ensure that patients have continued access to emergency and urgent care. TTSH transited the care for appropriate patients to its community care partners who are part of its integrated care network. These integrated care partnerships not just serve the hospital's patients during "peacetime" but are also vital during an outbreak for business and care continuity.

Post outbreak, TTSH will continue to shift care beyond the hospital into the community to build longer-term care relationships with patients. The hospital will not only look after patients





“Digital health will play a transformative role in enabling care beyond the hospital’s walls. It has been accelerated with shifts to telehealth and online ordering for home delivery of medications during the Circuit Breaker Period.”

who come through its doors but also serve the population that lives within its catchment area.

Digital health will play a transformative role in enabling care beyond the hospital’s walls. It has been accelerated with shifts to telehealth and online ordering for home delivery of medications during the Circuit Breaker Period.

State of Readiness

After the outbreak, the hospital will transit to a state of readiness for the next outbreak. It has to quickly incorporate lessons to be ready for the next one that can happen at any time.

Planning: Planning is key to making an outbreak a known unknown. It includes capacity planning, capability

development, and manpower planning and development. Every outbreak is different. We learn with every outbreak and make plans that are modular and flexible to meet emerging threats of different virulence and infectivity.

Preparedness: The hospital conducts regular exercises to test response systems, continual staff training in PPE to build confidence, and reviews of the hospital’s supply chain to ensure robustness. This is a continual learning process as what happens in between an outbreak is the difference in our ability to respond well to the next one. For the supply chain, we need to move beyond stockpiles to resiliency to trust. A system approach to supply chain management across

our health system, public and private partnerships and real-time visibility of stocks, and burn-rates provide assurances for all actors in the system.

People: It is proven time and time again that no plan is ever followed to a tee in an actual outbreak, and no amount of preparedness will fully suffice for the next outbreak. It is about planning, more than having a plan.

The process of planning establishes understanding and builds relationships. Preparedness extends planning to all levels of the hospital. Ultimately, it is always about people. TTSH has invested in a leadership and organisational development framework that is anchored in collective leadership across the hospital and with community partners. At the individual level, it focuses on engagement tools to build relationships. At the team level, it looks into tools to enhance teamwork. And at the organisational level, it develops networking tools to enable staff to work across teams and organisations to build partnerships. This is the essence of a future-ready organisation that can also respond in times of crisis.

To be ready is to build relationships in between crisis. Relationships are the foundation of the deep learning cycle within the organisation; the gel which brings people together to work as a system in readiness for the future, come what may.

Healthcare is first into the outbreak, last out of the outbreak, and always in between outbreaks. A continual learning approach is key for hospitals to respond, recover, and be ready for the next outbreak. To do so, we must re-learn, renew, and build relationships. It is an unfinished framework that every hospital can build upon with lessons learnt from every outbreak. These leadership lessons go beyond hospitals to other organisations, especially those in the frontline and service industries as our new normal in readiness for the next outbreak.

Professor Eugene Fidelis Soh is CEO, TTSH & Central Health.

NDP2020: SINGAPORE PAYS TRIBUTE TO FRONTLINE AND ESSENTIAL WORKERS

On 9 August, Singapore marked its 55th birthday with celebrations across the island, which were broadcast 'live' over TV and digital platforms. Themed *Together, A Stronger Singapore*, the National Day Parade (NDP) 2020 rallied Singaporeans to stay united as one people and work together to emerge stronger from the COVID-19 pandemic. NDP2020 also paid special tributes to frontline and essential workers battling the pandemic.

Senior Management and Staff from NHG were honoured to participate in segments, including the National Anthem and Pledge Moment, Mobile Column, Roar of Unity, and the NDP Parade at the Padang.





“ We will need this unity and resilience more than ever. The crisis is far from over. It will most likely take a year or two before a COVID-19 vaccine is widely available. Until then, we have to maintain our vigilance and resolve, to keep ourselves, our loved ones, and our neighbours all safe.

I am confident we will get through this current crisis, though it may take longer. All of us must do our part, but none of us will be alone. Our experience fighting COVID-19, grim and hard as it has been, has brought us closer together. The shared ordeal will toughen us as a whole population, and bond us together, as ONE UNITED PEOPLE.”

PRIME MINISTER LEE HSIEN LOONG






FY2019 HIGHLIGHTS OF NHG & INSTITUTIONS

“ Although the COVID-19 pandemic has been the primary focus of all our care efforts, we must take a moment to honour the NHG Family’s many noteworthy accomplishments in the past year.”

MADAM KAY KUOK
CHAIRMAN, NHG







“*River of Life:*
Time and tide wait for no man.
Laugh and love while you can.
Live well.
Leave well.”

MS WONG FONG TZE
GROUP CHIEF CORPORATE COMMUNICATIONS OFFICER, NHG

POPULATION HEALTH



“ In the pursuit of good health outcomes for our population, NHG adopts the 80:20 principle when designing our model of care. We build and strengthen the capacities and capabilities of the community to enable the **80 per cent** of residents who have mild health conditions to self-manage as far as possible. For the remaining **20 per cent** who have complex medical, psycho-social, and economic needs, we provide targeted interventions through a robust evidence-based approach.”

PROFESSOR PHILIP CHOO
GROUP CEO, NHG



POPULATION HEALTH



As rising frailty, growing chronic disease burden, and an increased prevalence of unhealthy lifestyle behaviours raise the demands on Singapore’s healthcare infrastructure, an illness-focused model of care is no longer sustainable. NHG recognises the urgent need to radically transform healthcare delivery through growing investment in upstream action. As such, our model of care increasingly focuses on population health – a strategy to improve health outcomes and keep public healthcare sustainable in the long term.



As the Accountable Care Organisation (ACO) for the Central Region, NHG's care transformation journey seeks to improve the health of our population of over two million residents through person-centred and relationship-based care. To help everyone live well, at every stage of life, NHG stratifies our population according to their needs, providing the right care at the appropriate time in the right setting. NHG offers value-driven services across the **Five Segments of Care** – *Living Well, Living with Illness, Crisis and Complex Care, Living with Frailty, and Leaving Well*. Our three Integrated Care Organisations (ICOs) – Central Health, Yishun Health, and Woodlands Health – have operationalised this model in three geographic zones to care for the distinct needs of each of its sub-populations. By working in regional zones, NHG leverages partnerships with health and social care organisations in the community to provide appropriate services across the Five Segments of Care.

DRIVING HOLISTIC HEALTH PROMOTION

● Partnering Community Stakeholders To Drive Health Literacy

In FY2019, NHG actively engaged patients and the community to raise awareness of health issues through various activities and outreach initiatives.

- In March 2019, Tan Tock Seng Hospital (TTSH) partnered Toa Payoh's Care Corner Senior Activity Centre (SAC) to organise *TTSH Dietitian Day*. Dietitians evaluated 200 elderly residents' risk of malnutrition with a screening tool and planned relevant activities. In collaboration with local charity, 'Food from the Heart', healthier and more nutritious food rations were provided.
- Yishun Health actively promoted awareness of the link between oral health and systemic diseases through its *Geriatric Health Carnival* (October 2019) and *Diabetes Health Fair* (November 2019).
- In October 2019, the Institute of Mental Health (IMH) and the National Council of Social Service (NCSS) led organisations, including the Agency for Integrated Care (AIC), Health Promotion Board (HPB), MINDSET Care Limited and the Singapore Psychiatric Association, to organise the ninth edition of the *Together Against Stigma (TAS)* international conference – a first for a South-east Asian country. The three-day conference, themed *Beyond The Label – Towards An Inclusive Society*, was co-hosted by Singapore and the World Psychiatric Association (Mental Illness and Stigma Section). It was graced by President Halimah Yacob and attended by more than 500 mental health professionals, researchers, community partners, advocates, service users, and caregivers.

TOP LEFT TTSH dietitians conducted health screenings for 200 elderly residents.

BELOW The *Together Against Stigma* international conference, co-organised by IMH, was graced by President Halimah Yacob.



POPULATION HEALTH

- In November 2019, IMH's Community Health Assessment Team (CHAT) celebrated its 10th anniversary with a carnival themed *Journeying Beyond the Decade*. Community partners supported the event by organising activities to raise awareness of youth mental health. Also featured were feline-assisted therapy, a human library, and an interactive theatre performance. *Lemonade*, an interactive card game designed by the CHAT ambassadors, debuted at the carnival.
- In FY2019, Woodlands Health Campus (WHC) held 23 health talks, fitness sessions, and information-sharing sessions for seniors in the North of Singapore to empower them to make healthy lifestyle changes. WHC also activated senior ambassadors known as *Woodlands Health Kakis* to encourage their peers to live healthily.
- As part of *World Heart Day* in September 2019, National Healthcare Group Polyclinics (NHGP) organised



roadshows at all six polyclinics to educate patients on the symptoms of cardiovascular disease and to promote lifestyle changes to minimise risks. Patients over the age of 40 were also encouraged to attend regular screenings for early detection and prevention.

- In conjunction with *World Mental Health Day* in October 2019, NHGP's psychologists gave a series of talks on *The Healing Power of Optimism for Mind and Body Wellness* targeted at seniors in the community and staff in the polyclinics.
- To mark *World Diabetes Day* in November 2019, NHGP organised roadshows at all its polyclinics to advise patients on good lifestyle choices – such as avoiding food with “hidden” sugars and exercising appropriately – that help reduce one's risk of developing diabetes. NHGP also put together an interactive supermarket tour to educate the participants on selecting healthier products and reading food labels.
- Ang Mo Kio Polyclinic and Yishun Polyclinic partnered St Luke's Eldercare and All Saints Home respectively to co-organise roadshows to celebrate *World Physiotherapy Day* in September 2019. In line with the theme, *Making Every Move Count*, 150 participants took part in strength and balance assessments, as well as a group exercise session designed to address common muscle pains.



LEFT IMH's CHAT celebrated its 10th anniversary with a carnival themed *Journeying Beyond the Decade*.

BELOW NHGP's *World Diabetes Day* interactive supermarket tour educated participants on selecting healthier products and reading food labels.





“ We don’t wait for patients to show up at our clinics after becoming sick. Rather, together with our partners, we offer a model of integrated services to keep our population well and in the community for as long as possible. We also encourage prevention and early detection so there is less need to seek care for chronic diseases and hospitalisation down the road.”

PROFESSOR CHUA HONG CHOON
DEPUTY GROUP CEO (CLINICAL), NHG
& CEO, INSTITUTE OF MENTAL HEALTH



- Between July and December 2019, the National Skin Centre (NSC) carried out free health screening and coaching activities twice a month for patients and their caregivers. NSC also offered the same services at the Department of STI Control (DSC) every month, and patients due for right-siting received coaching by NSC’s Right-Siting Officer (RSO).
- In FY2019, NHG Pharmacy (NHGPh) rolled out its annual national Pharmacy Week campaign themed *Own Your Medications, Own Your Health*. Patients across various institutions learnt to create and maintain their own medication list with the help of newly-developed patient education collaterals. Post-campaign surveys showed that the percentage of patients who kept a medication list increased to 54 per cent (up from 31 per cent in 2017).



TOP LEFT Shoulder strengthening exercises at Yishun Polyclinic as part of NHGP’s *World Physiotherapy Day*.

BOTTOM LEFT NHGPh’s annual national Pharmacy Week campaign themed *Own Your Medications, Own Your Health*.

ABOVE NSC offered free health screenings and coaching activities to its patients and caregivers.

BOLSTERING THE COMMUNITY TO COMBAT INFECTIOUS DISEASES

HIV OUTREACH EFFORTS

In December 2019, NCID's *I am more than HIV* campaign promoted understanding of and empathy for People Living with HIV (PLHIV). Additionally, a series of online videos that debunked public misconceptions about HIV was launched. Another activity – *Come and Eat with Us* – saw PLHIV, their family members, and healthcare workers sharing a meal. These efforts demonstrated solidarity with PLHIV, offering them a sense of normalcy.



- NCID Cares raised over \$260,000 for PLHIV through the *NCID Cares Charity Dinner*, which would go towards a range of needs, including providing medication for low-income patients, laboratory testing, supporting needy patients through the Red Ribbon Project, and other patient support group programmes.
- NCID's *World AIDS Day Human Library* facilitated open conversations between the public and people who had experienced prejudice, social exclusion or stigma due to HIV.

RAISING AWARENESS OF ANTIBIOTIC RESISTANCE

To raise awareness of antibiotic resistance as part of *World Antibiotic Awareness Week*, NCID conducted a library outreach event, with children's activity stations about bacteria, antibiotics, and hand hygiene. NCID also ran a community health talk on self-care tips to prevent the common cold and to debunk myths about vaccination.

LEFT NCID's HIV Public Forum.

BELOW NCID Cares raised over \$260,000 for People Living with HIV through the *NCID Cares Charity Dinner*.





COLLECTING DATA FOR EVIDENCE-BASED INTERVENTIONS

Through population-wide surveys, NHG assessed health behaviours and community needs to enable targeted and effective interventions.

THE SOCRATES STUDY

In January 2020, NCID launched a cohort-based study in Singapore to assess the population's knowledge, risk perception, and behaviour during the COVID-19 outbreak. The SOCRATES (**S**trengthening **O**ur **C**ommunity's **R**esilience **A**gainst **T**hreats from **E**merging **I**nfections) study offered updates, on a near real-time basis, on public awareness of current outbreak events and behaviours. It provided useful insights into how behaviours evolved during an outbreak in relation to control strategies. For example, key findings showed high trust in the Singapore government's ability to handle the outbreak, and confidence in official government communications. It also found social media to be the dominant source of information for the public.

INVESTING IN PREVENTION

COMMUNITY NURSING POSTS

WHC expanded its team of Community Nursing Posts (CNPs) in FY2019. To-date, community nurses across six posts (up from one in 2018) were deployed to help seniors and their families manage chronic conditions at home. WHC also embarked on the *Continuing and Integrated Care (CIC)*



pilot programme to address seniors' health needs holistically, by growing the network of health and nurse posts and building care partnerships with an existing network of social services.

NHGD BRINGS DIAGNOSTICS TO THE COMMUNITY

NHG Diagnostics (NHGD) expanded its community-based services in October 2019 with the launch of its second *Mammobus* and second *Mobile Bone Mineral Densitometry (BMD)* service to enable more accessible and convenient breast cancer and osteoporosis screening.

The new *Mammobus' Full-Field Digital Mammography (FFDM)* system could process radiographic images within six seconds, thereby increasing the productivity of Mammogram screening by 40 per cent and improving patient experience.

G-CARE (GLAUCOMA COMMUNITY-BASED AUGMENTED REVIEW AND EMPOWERMENT)

Yishun Heath's multidisciplinary *G-CARE (Glaucoma Community-based Augmented Review and Empowerment)* team, launched in FY2019, took existing community-based eye screening efforts conducted by *Community and Home Eye Screening Services (CHESS)* one step further to identify persons with Glaucoma conditions. The preliminary G-CARE pilot study showed an increase in the detection of Glaucoma-associated abnormalities (from 3.8 per cent to 8.3 per cent), improved cost-savings for patients and increased productivity.

LEFT CNPs address seniors' needs holistically and in the community.

RIGHT Community nurses across six posts help seniors and their families manage chronic conditions at home.



TOP The OMAHA System helps patients with mental illness continue their recovery in the community.

MANAGING MENTAL HEALTH IN THE COMMUNITY

Working closely with community partners, the NHG Family's mental health initiatives enabled early intervention for mental health conditions and promoted recovery and re-integration.

- In FY2019, IMH's *Aged Psychiatry Community Assessment and Treatment Service (APCATS)* – a community-oriented psycho-geriatric outreach service which promotes ageing-in-place for seniors with mental health issues – conducted 83 first visits and 865 repeat visits to seniors who faced challenges accessing mental health services on their own. In addition, the APCATS team equipped community partners with knowledge and skills in depression and dementia care, and improved follow-up processes. APCATS also reduced caregiver burden and prevented unnecessary admissions.
- In FY2019, the *Assessment Shared Care Team (ASCAT)* – an adult community psychiatric programme which manages patients with mild to moderate mental health conditions in the community – hosted two training workshops on various mental health topics for community

partners. The multidisciplinary team's of over 1,000 clients reported 100 per cent satisfaction, with over 60 per cent reporting a better quality of life.

- More than 25 children and adolescents with mental health conditions received encouragement and support through the *Card from The Heart Programme*, a collaboration between IMH and Ronald McDonald House Charities.
- IMH launched its *Recovery Oriented Transition Care Model (ROTCM)* in May 2019 to conduct intensive clinical services in inpatient and community settings, maximising patients' potential for re-integration. Results of the six-month pilot programme involving 92 patients from two wards showed a 13.9 per cent reduction in the average length of stay (ALOS) and a lower 30-day readmission rate of 5.8 per cent (compared to 12.1 per cent in the control group).
- In October 2019, the IMH Community Mental Health Team implemented the *IMH Community Nursing Competency Framework* and *OMAHA System* (an

“ Population Health aims to allow people to age well and stay healthy in the comfort of their own home: in their natural environment, close to their loved ones. During the pandemic, our values of people-centredness and compassion guided our teams to adapt our delivery of care in the face of many challenges, and kept our population safe in the community.”

PROFESSOR PANG WENG SUN
DEPUTY GROUP CEO (POPULATION HEALTH), NHG



information-based classification system) to help patients with mental illness function better and continue their recovery in the community. Of the 310 patients engaged, 50 per cent were better able to identify and address their problems effectively using the *OMAHA System*, with 10 per cent achieving their short-term goals over three months.

- In 2015, IMH started the *Aftercare Programme* for one pilot site and one community partner to provide case management support for patients with high social needs, post-discharge. As of March 2020, IMH had engaged five community partners and enrolled more than 900 patients in this programme. It reduced readmission rates and the number of emergency room visits by patients. Additionally, the number of patients with defaulted appointments dropped by 50 per cent. Collaboration between IMH and community partners helped ensure patients stayed on track to recovery.
- To facilitate the rehabilitation of patients who received inpatient care at IMH for many years, and re-integrate them into society successfully, IMH offers the *Slow Stream Rehabilitation (SSR)* programme. The *Sedap Café* was set up at the SSR ward in October 2019 to offer vocational training for patients interested in the Food and Beverage sector. Patients were required to pass a Workforce Skills Qualification Course (WSQ) and undergo further training and guidance in order to run the café. Six staff have been trained to-date.

RIGHT-SITING MENTAL HEALTH TREATMENT VIA EARLY INTERVENTION

Recognising the need for proactive extension of mental health access to youths in Singapore's healthcare landscape, Yishun Health offered a 13-week school-based mental health screening for Republic Polytechnic students. Seventy per cent of the 21 participants in this pilot collaboration were referred for follow-up care. Fifty per cent opted for follow-up care with Yishun Health and 75 per cent were treated by the psychiatrist who performed the initial assessment. Such assessments facilitated early diagnosis of mental health conditions and reduced treatment gaps for youths through early intervention.



ADVANCING HOME-BASED CARE

NHG improved access to quality home-based care to enable continuity of care in the community.

TTSH'S EARLY SUPPORTED DISCHARGE PROGRAMME

TTSH's *Early Supported Discharge (ESD)* programme seamlessly linked inpatient services to the community with support for patients and families as they transitioned from institution-based care to their homes. The programme is a joint initiative between TTSH Rehabilitation Medicine, Community Rehabilitation Programme (CRP), and the Departments of Neurology and Neurosurgery.

With the help of a care coordinator as a point of contact for patients and caregivers, the ESD facilitated discharge from the hospital, and offered contextualised rehabilitation by an inter-disciplinary team. The ESD's case management services expanded to include non-stroke neurological cases in 2017, hip fracture cases admitted under the Hip Fracture Clinical Pathway in 2018 and since 2019, has had an increasing number of suitable patients.

TOP TTSH's *Early Supported Discharge* programme enables patients and caregivers to transition smoothly from hospital to home.

YISHUN HEALTH'S STRATEGIES FOR SENIORS TO AGE-IN-PLACE

- Yishun Health's *Ageing-in-Place-Medical Home (AIP-MH)* serves patients with acute or sub-acute medical problems whose conditions had stabilised. In FY2019, AIP-MH provided quality care in the community, with home nursing, therapy, and medical services, as well as intravenous antibiotics previously only available in hospital-based care. AIP-MH offered 24/7 phone support and daily home visits.

- The *Ageing-In-Place-Community Care Team (AIP-CCT)* – nurse-led teams supported by multi-disciplinary healthcare professionals – expanded its spectrum of home healthcare services to serve patients' heterogeneous needs in FY2019. These included:
 - Extended hospital-to-home services (beyond six months) for patients with chronic relapsing or recurrent symptoms

 - Home rehabilitation for early supported discharges who required active rehabilitation

 - New discharge measures allowing stable patients from the Accident and Emergency Department (A&E) or the Extended Diagnosis Treatment Unit (EDTU) to return home for functional or psycho-social assessments

“ We should work hand-in-hand with our health and social care partners in the community to help our population live well by improving their physical and psycho-social environment, and social support, as well as equipping them with skills to care for themselves and each other.”

DR WONG SWEET FUN
CHIEF TRANSFORMATION OFFICER, YISHUN HEALTH



THIS PAGE Home rehabilitation services were among extended hospital-to-home services offered by Yishun Health's AIP-CCT.



CULTIVATING A COMMUNITY OF CARERS

NHG adopts a well-rounded, systems-based approach to enable health, treatment, and recovery. We reach out to multiple stakeholders such as volunteers, families, schools, and community organisations to provide holistic care for our patients and our population.

VOLUNTEER ENGAGEMENT

- In FY2019, TTSH operationalised its ethos of being a *Hospital Without Walls* by serving its community alongside 70 partners, with support from its Community Health Teams (CHTs). To-date, 90 volunteer carers have been trained under TTSH's Centre for Health Activation's (CHA) *CHArge Up!* programme. Carers were equipped with para-clinical skills of medication management, chronic disease management, and gait assessment. In addition, CHA's *Health Activation Community of Practice (HACoP)*

was established to engage multiple stakeholders to co-create solutions to address our healthcare system's challenges.

- Yishun Health's initiatives equipped volunteers to complement the work of healthcare workers, allowing them to enhance clinical care by operating at the top of their licence.
- Launched in August 2018, KTPH's *Acute Stroke Unit (ASU)* volunteer programme enabled volunteers trained by occupational therapists and physiotherapists to care for stroke patients. In FY2019, volunteers' competencies were upgraded to perform group therapy sessions and bedside activities. The ASU would be expanding this programme to other wards, such as the Neurosurgery department.

TOP NHG engages multiple stakeholders to provide holistic care for our patients and population.



“ Our leaders at all levels are responsible for engagement with our community to build meaningful relationships and provide better care together. We hope to build a hospital without walls, where care follows our patients, and is delivered through a network of partners.”

PROFESSOR EUGENE FIDELIS SOH
CEO, TAN TOCK SENG HOSPITAL & CENTRAL HEALTH





○ In November 2019, Yishun Health held its inaugural *Volunteer Appreciation Day* with a lunch at Nee Soon Central Community Club to acknowledge and appreciate volunteers for their hard work, support, and contributions in caring for patients. About 187 people from over 18 volunteer groups attended. Minister K Shanmugam and Associate Professor Muhammad Faishal Ibrahim, Members of Parliament for Nee Soon Group Representation Constituency (GRC) graced the event.

EMPOWERING SUPPORT SYSTEMS

● Observing that complex family dynamics could be a hindrance to a patient’s mental well-being, Yishun Health set up a *Family Counselling Service* in February 2019 to engage families as allies in a patient’s recovery journey. With patients’ consent, the service assessed the interaction patterns of families referred by in-house mental health professionals, and leveraged each family’s strengths to create a positive home environment. In the first quarter of FY2020, the team developed outcome-monitoring tools to track progress. In response to COVID-19, the hospital implemented Zoom-based counselling services, while implementing robust cyber-security measures.

● To combat social and emotional isolation, Yishun Health’s *Stroke Survivor Support Group (SSSG)*, a collaboration with the Singapore National Stroke Association (SNSA), offered a platform for stroke survivors to provide peer-to-peer emotional support. This six-session programme facilitated care continuity in the community, helping patients cope with lifestyle adjustment and preventing stroke recurrence.

TOP Yishun Health’s inaugural Volunteer Appreciation Day.

BELOW Yishun Health’s *Stroke Survivor Support Group* offers stroke survivors peer-to-peer emotional support.





EQUIPPING SCHOOLS AND COMMUNITY ORGANISATIONS

- In June 2019, WHC launched a pilot immersion programme involving 15 students from Christ Church Secondary School. The programme enables students to understand more in-depth ageing challenges. The interactive programme was designed to build empathy among students and help them appreciate how they could contribute to serving elders in the community.
- In July and September 2019, WHC expanded its community-based *Share a Pot®* initiative, aimed at improving the social and physical well-being of community-dwelling seniors. Two more *Share a Pot®* sites were launched at Blossom Seeds SAC and Anglican Senior Centre (Woodlands), empowering, engaging, and mobilising volunteers to positively impact their communities. At the new sites, students, corporate volunteers and seniors built synergistic bonds over group exercises and nutritious soups. Activated seniors at Blossom Seeds SAC also led cooking, exercise, and craft-making activities, building a supportive community where seniors could look after one another.



TOP & LEFT Student volunteers from Woodlands Secondary School organised a *Share a Pot®* session as part of initiatives to build a supportive community where seniors could look after one another.

BELOW Seniors at the new Blossom Seeds Activity Centre *Share a Pot®* site, launched in July 2019.





SUPPORTING STAFF WELL-BEING

In FY2019, the NHG Family championed several initiatives to foster physical, mental, and social health in the workplace.

- NHG's Group Quality and Clinical Governance (GQCG) department launched the *Joy in Work (JIW)* movement, helmed by Professor Chua Hong Choon, Deputy Group Chief Executive Officer (Clinical), NHG. Teams were encouraged to implement *JIW* initiatives in their respective work areas after the pilot session was rolled out in July 2019 to help colleagues rediscover joy in work and instil a culture of support throughout NHG.
- In April 2019, KTPH was awarded a Culture of Health grant to pilot initiatives that promote a culture of health in the workplace. The team piloted the *Mindful Moments Initiative* across Yishun Health to create a culture of positive mental wellness through education, empowerment, and engagement in activities.



Joy-in-Work toolkit

ANG MO KIO SPECIALIST CENTRE OPENS

The Ang Mo Kio Specialist Centre (AMKSC) opened with a soft launch in December 2019. AMKSC is operated by TTSH and serves to pilot innovative models of care alongside health and social care partners in Central Singapore. Its location within central Ang Mo Kio shifts healthcare delivery beyond the hospital and into the community, thus bringing patient-centred care closer to home.

CLINICAL CARE



“ We want our system to encourage patients to participate in their recovery journey, as partners with our healthcare teams.”

ASSISTANT PROFESSOR ERIC WONG
GROUP CHIEF CLINICAL INFORMATICS OFFICER, NHG



CLINICAL CARE

With Singapore's ageing population and complex healthcare needs, NHG is redesigning our processes to integrate health and social care services for our patients and the population we serve. We have expanded our scope and reach of care in the Central Region, to include our community partners, patients and their families to provide holistic, seamless, and person-centred care.



CLINICAL GOVERNANCE

NHG CLINICAL BOARD STRATEGIC RETREAT

In November 2019, senior clinical leaders from the medical, nursing, and allied health disciplines across NHG attended the NHG Clinical Board Strategic Retreat organised by Group Quality and Clinical Governance (GQCG). Themed *Re-imagining Clinical Care*, they identified action plans and key strategic initiatives for NHG.

HARNESSING CLINICAL SYNERGY AND STRATEGIES

To achieve the Triple Aim*, one key driver is the ability to leverage on clinical synergy across NHG. Five models of clinical collaboration have been identified:

- 1 Model A – External specialty centre/agency
- 2 Model B – Internal specialty centre/agency
- 3 Model C – Specialty/professional group
- 4 Model D – Hub and spoke
- 5 Model E – Community of practice

In FY2019, NHG implemented several initiatives to harness clinical synergy across the cluster. They included:

● **NHG Heart Institute**

In June 2019, the cardiology departments of Tan Tock Seng Hospital (TTSH), Khoo Teck Puat Hospital (KTPH), and Woodlands Health Campus (WHC) jointly established the NHG Heart Institute. It aims to synergise the provision of cardiology services across NHG to meet present and future population health needs. Associate Professor David Foo, Senior Consultant, Cardiology, TTSH, was appointed Medical Director of the NHG Heart Institute.

● **NHG Joint Innovations Oncology Taskforce**

The NHG Joint Innovations Oncology Taskforce (NHG JOINT) was formed in August 2019, with representatives from all acute care institutions, to facilitate

the development of a comprehensive oncology care delivery plan across the cluster.

● **Central Regional Trauma Framework Committee**

The Central Regional Trauma (CRT) Framework Committee was established in July 2019 to facilitate the development of comprehensive trauma care delivery within the Central Region of Singapore as part of the Acute Trauma Care Framework, an initiative led by the Ministry of Health (MOH). Dr Teo Li-Tserng, Senior Consultant, General Surgery, TTSH, was appointed Regional Trauma Director (Central), and heads the Committee. The CRT Framework aims to ensure right-siting of care for acute trauma patients, appropriate provision and utilisation of critical resources, and to deliver a structured and coordinated approach for research, education, and quality assurance in acute trauma for the Region. By ensuring balanced acute trauma patient-load, the Framework has brought about timely delivery of appropriate clinical care and management of more complex patients in higher-tier centres.

Below Senior clinical leaders from the medical, nursing, and allied health disciplines at the NHG Clinical Board Strategic Retreat 2019.

* The Institute for Healthcare Improvement's (IHI) Triple Aim Framework provides strategic direction and focus for improving health outcomes through the simultaneous pursuit of three dimensions: improving patients' experience of care, improving the health of the population, and reducing the per capita cost of healthcare.



BUILDING A CULTURE OF QUALITY AND PATIENT SAFETY

CLINICAL RISK MANAGEMENT

In May 2019, NHG designed and developed a new mental model to facilitate understanding of an integrated risk management approach. Prior to this, risk management in NHG largely focused on one risk domain. The new model enabled better integration of risk management into strategic planning, which in turn, helped drive quality and safety, as well as ensured sustainability and growth.

Called Ask SRI², the model encouraged staff to determine Safety (S), Risk (R), and Improvement and Innovation (I²) issues to help NHG achieve our strategic goals. It supported the proactive identification and management of risks, and provided assurance that NHG’s objectives were achieved within an acceptable degree of residual risks. It also guided management decisions for resource allocation,

preparedness for crises, audit planning, and assurance processes.

To equip clinical staff and risk leads with the necessary knowledge and skills, a training workshop, *Integrating Safety, Risk and Improvement in NHG*, was piloted in September 2019, and formally introduced in January 2020. The workshop emphasised engagement of staff at the Senior Management, Directorial, Managerial, and Ground-levels using the SRI² model, and ways to identify the connections between clinical risks and other risk domains (Figure 1). This improved staff’s ability to identify, integrate, and manage risks across NHG.

To complement the internal analysis process, NHG subscribed to the Emergency Care Research Institute’s (ECRI) online resource portal, Healthcare Risk Control (HRC). This would strengthen our ability to pro-actively scan for risks and detect emerging healthcare trends, as well as

FIGURE 1. Risks in NHG are framed according to 10 domains: Strategic, Clinical/Patient Safety, Operational, Infrastructure & Equipment, Financial, Human Capital, Technology, Legal/Regulatory, Research, and Education.



help identify international best practices, evidence-based solutions, education resources, and tools.

STANDARDS ACCREDITATION AND RESOURCE UNIT

NHG’s Standards Accreditation and Resource Unit (SARU) supports the efforts of our Institutions in ensuring relevant practices and sustained compliance with current, evidence-based standards. This is achieved through the adoption of pertinent standards, training staff to understand requirements of the standards, ensuring that policy and process align, and compliance of practices on the ground through auditing and learning.

In FY2019, SARU focused on three areas – training of staff in new standards, working with staff to review policies and applying new standards in the local context, and, auditor training. In addition, SARU conducted a series of training for new and existing internal auditors.

PATIENT SAFETY CULTURE SURVEY 2019

Since 2005, NHG has been conducting bi-annual surveys to understand and assess how patient safety culture is perceived by staff. By periodically evaluating, measuring, and benchmarking the impact of patient safety initiatives on its safety culture, NHG was able to determine the areas that needed improvement. This in turn produced better care outcomes and value for patients, staff, and the organisation. The survey tool used was adapted from the Agency for Healthcare Research and Quality (AHRQ).

Results from a survey conducted between August 2019 and January 2020 showed that NHG was proactive about patient safety, with an overall Patient Safety Index of 65 per cent. NHG’s main area of strength continued to be “organisational learning and continuous improvement”, which consistently ranked above the national and the AHRQ average.

SPREAD AND SCALE FRAMEWORK

In April 2017, GQCG developed a Spread and Scale Framework, which used a three-stage, nine-step approach to provide institutions with a roadmap to roll out their successful improvement initiatives at scale.

In FY2019, GQCG augmented the Framework with the NHG Spread and Scale Toolkit, which incorporated good practices, evidence-based approaches,



and quality improvement (QI) tools to measure improvement projects. GQCG would be launching an IT system for Spread and Scale to serve as a central learning site across NHG in 2021. The system would support leaders and teams in achieving improvement and innovative uptakes on a wider scale, build a community of practice, and promote a strong culture of improvement within NHG.

APPROPRIATENESS OF CARE FRONT WORKGROUP

Yishun Health established the Appropriateness of Care Front Workgroup in March 2018, which promulgated rational, patient-centred, evidence-based and cost-effective healthcare service delivery principles and practices among healthcare professionals. These principles and practices, governed by standardised protocols and guidelines, were derived from internal and external benchmarking, as well as local and international evidence. Focusing on the 3Es (Effective, Efficient, and Ethical), the Workgroup came up with four pillars to support the stewardship of appropriateness of care in Yishun Health:

● **End-To-End Care**

This served as a reminder that care must be effective, efficient, and in line with ethical principles of fair allocation. The usage of allocated resources in the course of providing care to a patient across the continuum of care should be prudent, with clear roles and responsibilities defined for care providers. Healthcare professionals must also build

trust with their patients, and involve them and their families in educational initiatives to advocate and promote self-care.

- **Evidence-based Practices**

This advocated the use of local and international best practice guidelines, such as the Agency for Care Effectiveness (ACE) and the MOH Clinical Practice Guidelines, to achieve clear clinical and operational outcomes. This would address inappropriate care such as overuse, underuse, misuse, and unjustified variation of care.

- **Utilisation Management And Cost-effectiveness**

This supported the use of data to make rational decisions on conducting investigations, and consumables, medications, and site of care for the patients. It also included the reasonable use of devices, implants, and consumables or drugs for patients.

- **Risk Assessment And Mitigation**

This helped safeguard patient safety. The Failure Mode and Effects Analysis (FMEA) should be carried out for new initiatives or changes in current practices.

In FY2019, the Workgroup collaborated with staff from the Infection Control Programme, Antibiotic Stewardship Programme (ASP), and the Diabetes Centre on the following initiatives:

- **Improving Communication Among Care Teams**

The Workgroup and the Diabetes Centre produced a brochure and checklist on diabetes care to standardise communication of HbA1C among the care teams. This improved patient awareness and knowledge of HbA1C, thereby enabling individuals to better manage their conditions.

- **Launch Of Appropriateness Of Care Campaign And Logo**

The Workgroup designed a 3E logo that helped identify and encourage staff to align to and integrate the principles of Appropriate Care with their daily work. The logo was used in collateral for the Hand Hygiene and Antibiotic Resistance Awareness Campaigns to generate awareness and reinforce good practices.



TOP The 3E logo designed by Yishun Health's Appropriateness of Care Front Workgroup

IMPROVING INPATIENT CLINICAL EXCELLENCE

IMPROVING CARE FOR PATIENTS WITH END-STAGE CANCER

To provide more timely and appropriate care for patients with end-stage cancer, TTSH's Department of Palliative Medicine and Emergency Department (ED) collaborated with Dover Park Hospice in 2015 to introduce a three-year programme – **Emergency Department-PAL**liative **Ser**vice (ED-PALS) – for such individuals when they visit the ED. Under the programme, eligible patients with specific symptoms such as sudden pain, vomiting, or breathlessness would be seen by the palliative care team within a few hours, given a referral to the Specialist Outpatient Clinic, or referred directly to the Hospice's home care or inpatient services. This would cut down waiting time and improve access to more timely care, as well as reduce unnecessary admissions and processes via the ED.

ENHANCED RECOVERY AFTER SURGERY PROGRAMME

First implemented in 2016, TTSH's Enhanced Recovery After Surgery (ERAS) programme helped speed up post-operative recovery and lowered admission costs for patients undergoing major surgery, based on protocols designed from evidence-based best practices. ERAS



encompassed multimodal, multidisciplinary guidelines, and sought to be the standard framework for peri-operative care for all surgical procedures.

The programme brought about average savings of S\$2,197 for each of the more than 700 colorectal surgery patients in 2018, and almost halved the Average Length Of Stay (ALOS) from 10.6 days in 2015 to 6.5 days in 2019. It also reduced the proportion of patients who had severe complications post-surgery, from 5.42 per cent in 2015 to 4.3 per cent in 2019. The proportion of patients who were re-admitted within a month dropped, from 10.26 per cent in 2015 to 6.4 per cent in 2019. Majority of the patients who benefitted had undergone colorectal surgery, with the remaining patients from various specialties such as upper-gastro intestinal, liver, pancreas and urology. TTSH would be expanding the ERAS programme to other forms of surgery, such as breast, ear, nose and throat, as well as knee replacement operations.

REMOVE PROJECT

The Ophthalmology & Visual Sciences (OVS) department at KTPH collaborated with the Day Surgery Centre (DSC) to introduce the REMOVE (Removal of Eye Medications for Value-add and Efficiency) Project. Part of the Lean Cataract Surgery Care Path, it removed the need for patients to apply prophylactic pre-operative antibiotic eye drops (PPAD) three days prior to surgery to sterilise the surgical site. If patients failed to do so, the surgery would be cancelled or delayed. According to results of a previous pilot, the omission of PPAD as part of the pre-operative process did not result in complications.

The REMOVE Project was officially rolled out to all cataract surgeries in May 2019. Between December 2018 and December 2019, a total of 1,982 cataract surgeries were performed without PPAD, with no reports of post-operative eye infection. As a result, the number of cancelled cataract surgeries declined, and patient safety was enhanced due to a decreased risk of drug-related adverse reaction or allergy from the usage of multiple eye drops. This led to greater convenience, reduced waiting time, and cost-savings for patients as they no longer had to make additional trips to the pharmacy to purchase the PPAD. The project helped optimise manpower and resource utilisation across the various departments.



ENHANCED TRANSDISCIPLINARY CARE FOR PATIENTS WITH HEART FAILURE

To improve health outcomes for patients with heart failure and prevent frequent hospital readmission, Yishun Health established the Integrated Transdisciplinary Heart Failure Unit in 2016 to deliver seamless and person-centred care across the care continuum. It comprised a multidisciplinary team of cardiologists, case managers, advanced practice nurses, cardiac pharmacists, allied health professionals, and operation administration staff. The Unit reduced readmissions, improved clinical and functional outcomes of patients upon discharge, and provided good quality cardiac care while keeping costs affordable.

BELOW Representatives from Yishun Health's Integrated Transdisciplinary Heart Failure Unit presented their poster on Heart Failure Management at the Value Driven Care Conference 2019.



CLINICAL CARE

Some initiatives included definite care plans, the setting up of an early post-discharge review clinic run by advanced practice nurses, direct phone access to case managers for post-discharge queries, and patient education to self-manage worsening symptoms. The team advocated preventive measures including pneumonia and influenza vaccinations, as well as device implants for long-term heart failure management.

This resulted in fewer unplanned readmissions within 30 days of discharge from 9.96 per cent in 2016 to 7.17 per cent in 2019, well below the national target. Inpatient mortality rates also dropped from 2 per cent to 0 per cent, and held for three years from 2017 to 2019.

INTEGRATED EMERGENCY LAPAROTOMY CARE PATHWAY

An emergency laparotomy (ELAP) is commonly performed as life-saving surgery for patients with acute abdominal catastrophic conditions such as bowel obstruction and perforation. These patients often are older persons with complex care issues. The procedure also has a higher risk of mortality and post-surgical complications compared to other high-risk elective surgeries.

In January 2019, KTPH redesigned and introduced an Integrated ELAP Care Pathway to streamline and standardise best practice care processes to ensure the delivery of consistent perioperative care. Transdisciplinary teams consisting of emergency physicians, surgeons, anaesthetists, and geriatricians worked




together to identify patients and provide comprehensive care plans for them. This ensured patients were supported throughout their care journey, including the ED stage, Pre-Operative stage, Post-Operative and Recovery stage, and Discharge stage.

The integrated approach resulted in better preoperative assessment of more patients, increased specialist presence in surgery, and holistic geriatric management in the general ward. It also reduced mortality rates, improved patient functional outcomes, increased patient satisfaction, and generated cost-savings for patients and the hospital.



OFFICIAL OPENING OF THE CARDIAC CENTRE AT TTSH

In October 2019, TTSH officially opened The Cardiac Centre, which co-located the majority of cardiology services on a single floor. It houses subsidised and non-subsidised clinics, the Cardiac Ambulatory Services, a Cardiac Rehabilitation Gym, as well as the Cardiac Imaging Centre which provided Nuclear Cardiac Imaging, Cardiac CT, and Echocardiography services.



“ NHG’s strong commitment to patient safety and quality improvements put us in a very good state to handle COVID-19. When we have patient safety and quality at the back of our minds, we ensure changes made are strong, safe, and secure.”

PROFESSOR CHUA HONG CHOON
DEPUTY GROUP CEO (CLINICAL), NHG
& CEO, INSTITUTE OF MENTAL HEALTH

WOODLANDS HEALTH CAMPUS MODEL OF CARE

To transform and better deliver integrated care, Woodlands Health Campus (WHC) is developing New Care Models to provide a seamless journey for patients from hospital to home. Instead of a one-size-fits-all approach, patients would receive integrated, person-centred, holistic, and seamless care, i.e. needs-based intelligent clinical care. The WHC Model of Care involves the co-creation and active sharing of real-time information about patients' personalised care goals and treatment plans – among caregivers and multidisciplinary clinicians from hospital to community sectors – on a single platform.

Alongside these New Care Models, WHC is implementing pre-hospital initiatives to reduce unnecessary hospital admissions. To facilitate quicker transitions and more efficient discharge, WHC has set a target of an ALOS improvement over the current norms. This would be achieved by right-siting patients, frontloading investigations, and streamlining workflows to improve efficiency and throughput. Having a strong transitional care team with community empowerment through sustained engagement, would help facilitate patients' safe, and supported earlier return to the community.



SIX WARDS IN OPERATION

In 2019, WHC expanded its clinical functions through the progressive opening of additional pre-operations wards at Yishun Community Hospital (YCH) and TTSH, bringing the number of wards operated by WHC to six. This facilitated better training of clinical, nursing, allied health, and operations teams in direct patient care, enabling them to be prepared when the Campus is completed and ready for operation.

For example, Ward 82 @ TTSH CDC2 was set up as an Acute Frailty Unit (AFU) for the sub-specialty of Palliative Medicine, as well as Geriatric Medicine. A sandbox concept, the AFU was a collaboration between WHC and TTSH's Geriatric Medicine Department to pilot a model of care for a specific group of frail senior patients.





WHC CAMPUS DEVELOPMENT

In FY2019, WHC completed the final stage of design development and design validation, using mock-ups and prototypes. Construction of the future campus is underway, with basement works close to completion, and building works for the Integrated Acute and Community Hospitals, Medical Centre, and Long-term Care Block progressing well.

Gaining experience from the COVID-19 outbreak, WHC reviewed its campus design to adapt to emerging evidence and industry recommendations on infection control. This included catering for clinical facilities in infection prevention, isolation, and surge capacity, public space and work space with safe distancing design elements, and technology enablement for tele-conferencing.

ENHANCING REHABILITATION FOR PATIENTS

DECOMMISSIONED TAXI FOR THE NEW INTEGRATED CARE HUB

In December 2019, ComfordelGro donated a decommissioned taxi to TTSH for the new Integrated Care Hub (ICH). The taxi was used for car transfer training, an important part of rehabilitation where occupational therapists trained caregivers of patients with mobility issues to get in and out of the vehicle safely.



PLAYKAKI PROGRAMME

In July 2019, Yishun Health's Sport Medicine Centre, Rehabilitation Services, and Volunteer Management Team jointly rolled out the PlayKaki programme to engage patients undergoing rehabilitation. The platform provided patients who were recovering from acute illness opportunities to take part in physical activities through adapted sports. Volunteers were first matched to their respective roles based on interests and abilities, and were subsequently trained by therapists to facilitate adapted sport for patients. The programme was well-received, with high engagement from volunteers and patients.



COLLABORATIONS FOR BETTER CARE



TOP TTSH, TTSH Community Fund, and SATA CommHealth signed an MOU to renew their partnership for the SATA CommHealth DOT & SHOP programme.

DOT & SHOP PROGRAMME

In March 2019, TTSH, TTSH Community Fund, and SATA CommHealth signed a Memorandum of Understanding (MOU) to renew their partnership for the SATA CommHealth DOT & SHOP programme until December 2020. The programme offered supermarket vouchers to needy patients with tuberculosis (TB), to motivate them to complete their Directly Observed Therapy (DOT). Since its launch in 2009, the DOT & SHOP programme had disbursed more than S\$600,000 worth of supermarket vouchers to over 1,900 patients. Under the MOU, the programme would also provide assistance for transport costs for some patients undergoing DOT at polyclinics or the Tuberculosis Control Unit (TBCU).

COLLABORATING TO HELP PATIENTS WITH ALCOHOL USE DISORDER

In April 2018, the Institute of Mental Health's (IMH) National Addiction Management Service (NAMS) launched a pilot Alcohol Assertive Community Team under the Community Addictions Programme (CAP), to help patients with severe Alcohol Use Disorder who refused to seek help at NAMS outpatient clinics. The team applied Assertive Community Treatment (ACT) principles to manage this group of patients which included home/community visits, holistic care management, and harm reduction approach. The Alcohol Assertive Community Team successfully reduced alcohol-related Accident and Emergency (A&E) visits, and improved mental health, psycho-social and occupational

functioning in Alcohol-Related Frequent Attenders (ARFAs). ARFAs is used as a reference for patients with six or more alcohol-related A&E visits over a period of 12 months. This pilot was carried out over a six-month period, during which close partnerships were established with community partners for follow-up and long-term care arrangements for the patients.

In September 2019, the Alcohol Assertive Community Team received an approved four-year funding to expand the initiative to four public hospitals. NAMS would be a consultant to these hospitals as they set up their respective ACT teams.

FRAILTY PILOT AT TOA PAYOH POLYCLINIC

Toa Payoh Polyclinic piloted the *Frailty Screening Programme* to screen elderly patients for frailty in August 2019. Frail elderly patients were taught appropriate nutrition, fall prevention measures, and home exercises. Those with milder degrees of frailty were referred to community exercise programmes run by the People's Association (PA) and the Health Promotion Board (HPB) through the Community Network for Seniors. The goal of this programme is to keep seniors active, healthy, and independent so that they can age in place with dignity in their communities and homes. As of March 2020, some 1,300 patients were screened and 40 per cent were identified to be frail.



PROVIDING PERSON-CENTRED CARE FOR PATIENTS WITH DIABETES

From July 2019, the National Skin Centre (NSC) started collaborating with TTSH to refer patients with likelihood of diabetes to the TTSH Endocrine Clinic for the DMVascular Clinical Trial. Participants included patients or members of the public who had a Body Mass Index (BMI) of 23 and above, a family history of diabetes, a history of gestational diabetes, or recent diagnosis of diabetes but who were not on medication. From August to December 2019, some 11 patients participated in the trial and were referred to TTSH.

“As we continue aspiring towards person-centric care for our patients, we need to step out of our comfort zones, and build stronger trust among individuals and across care teams, with our patients and also partners in the community.”

ASSOCIATE PROFESSOR PEK WEE YANG
CHAIRMAN MEDICAL BOARD, KHOO TECK PUAT HOSPITAL & YISHUN HEALTH

PHARMACY TRANSFORMATION

Pharmacy Transformation in NHG started with the vision of keeping our population well through safe and appropriate medicine use. To improve medication safety and during transition of care, initiatives focused on three areas:

- **Creating a Single Source Of Truth (SSOT):** Establish platform(s) to provide a SSOT for Medication Lists to ensure that the same Medication List is visible to all healthcare professionals across various platforms.
- **Patient Activation:** Ensure that patients are activated to own and manage their Medication List without relying on the systems or platforms. This works as a more sustainable approach to maintain the SSOT.
- **Quality Prescribing:** Engage the whole system of healthcare providers with the ultimate goal of accurate prescribing and appropriate prescription for patients. This will further strengthen the SSOT.

STREAMLINING COMMUNICATIONS BETWEEN PRESCRIBERS

Patients who regularly see multiple prescribers across institutions often have changes made to their medications. The continuity of such information from one prescriber to another is essential to ensure accurate medication records and to avoid potential harm to patients. In FY2019, NHG Institutions jointly developed Prescribing



Practice Guidelines and a standardised patient referral template, which were subsequently shared cluster-wide for adoption. Core messages incorporated in the recommendations included communicating medication changes and annotating the reasons for medication change. Both the guidelines and the template have since been included in the future Next Generation Electronic Medical Records (NGEMR) prescribing system to institute the practices and processes for safer care.

TOP The Outpatient Pharmacy Automation System (OPAS) used by NHG Pharmacy improved the efficiency and speed of medication dispensing, as well as enhanced staff productivity and patient safety.



TOP The Singapore Standards on Guidelines for the Supply and Delivery of Medication (SS 644) Working Group.

SUPPORTING THE SAFE DELIVERY OF MEDICATION

To future-proof our healthcare system and ensure the safety and quality of medications delivered to patients, the Singapore Standards on Guidelines for the Supply and Delivery of Medication (SS 644) was jointly established by the Singapore Standards Council (SSC), Pharmaceutical Society of Singapore (PSS), and Singapore Manufacturing Federation-Standards Development Organisation (SMF-SDO). The SS 644 was developed with support from a working group comprising representatives from TTSH and NHG Pharmacy, together with experts from the regulatory, pharmacy, medical, and logistics sectors. It is the world's first standard on the supply and delivery of medication.

In October 2019, Mr Edwin Tong, former Senior Minister of State for Health and Second Minister for Law, officially launched the SS 644 at the 29th Singapore Pharmacy Congress. The Pharmacy Services Centre of NHG Pharmacy was subsequently selected to be a case study as part of the official launch programme in November 2019. The SS 644 has since been incorporated widely by many healthcare and logistics service providers, including MOH, which referenced the Standard as one of the guidelines required to implement a telemedicine service.

TRANSFORMING MENTAL HEALTH CARE

REDUCING POLYPHARMACY IN RECOVERY CARE WARDS

In November 2018, 52 long-stay patients at IMH with different conditions and who were taking two or more antipsychotic medications (polypharmacy), were

recruited across six recovery care wards for a pilot, which aimed to reduce their medications. They were found to be suitable for deprescribing – the process of reducing or stopping medications under supervision to improve one's health or reduce the risk of adverse side effects. Within six months, 50 per cent of the recruited patients in the pilot successfully reduced their number and/or dosage of antipsychotics. Buoyed by the positive result, a team comprising pharmacists, advanced practice nurses, doctors, and operations staff worked together to replicate the project on a larger scale. As of February 2020, 58 per cent of the 52 patients had achieved a dosage reduction in their antipsychotic medications, and 38 per cent of them had achieved monotherapy.

Besides co-managing patients on antipsychotic polypharmacy with the care teams, IMH pharmacists also developed an Antipsychotic Treatment Algorithm to guide clinicians' deprescribing decisions. The guide, together with an Onboarding Kit, would eventually be launched across 21 recovery care wards.





REINTEGRATING PATIENTS INTO THE COMMUNITY THROUGH EMPLOYMENT

One of IMH's goals is to rehabilitate patients back into society, and help them regain their independence. To support this, the Slow Stream Rehabilitation (SSR) Programme was set up in 2015. As part of this initiative, IMH launched the *Sedap Café* at the SSR ward in October 2019, a training venue for patients interested to work in the Food and Beverage sector. They were required to pass a Workforce Skills Qualification Course, and undergo further training and guidance by staff in order to run the café. This provided an opportunity for long-stay patients to learn new skills and improve their independent living skills, regain confidence, gain employment, and eventually reintegrate into society. In FY2019, 15 patients were discharged with the help of the SSR Programme.

TRANSFORMING MENTAL HEALTH CARE FOR PATIENTS

In February 2019, IMH opened the pilot Recovery Centre following the successful adoption of the rehabilitation care model from its slow stream rehabilitation ward. It aimed to meet the rehabilitation needs of more patients and help as many stable patients as possible to return to the community. Patients from the 30-bedded male ward were encouraged to choose from an array of programmes and activities based on their interests and goals. These

included recovery workshops, cognitive behavioural therapy groups, cognitive remediation therapies, education and life skills groups, meditation sessions, and various recreational and leisure activities.

To enhance care for patients, several processes were redesigned in October 2019. The open-door policy of the ward empowered patients to leave the ward at stipulated timings for visits to the grocery stores, banks, and community centres, so that they could apply the skills learnt from the programme in real life. Patients were also encouraged to devise their own coping strategies, documented in a "Personal Wellness and Recovery Plan" booklet.

Peer Support Specialists (PSS) conducted weekly recovery workshops, tailored to the needs and goals of the patients, to discuss their lived experiences. In addition, nurses organised regular recovery support group sessions where patients shared their personal success stories and brainstormed ideas to overcome challenges. This fostered interpersonal learning, and cohesiveness among the members.

Since its implementation, patients shared that they were better aware of mental health, advocacy, and personal power in wellness and recovery. The pilot centre enabled IMH to fine-tune its rehabilitation programmes while waiting for two permanent Recovery Centres to be ready in 2021. These new centres would cater to male and female patients for active rehabilitation.

DESIGNING A NEW MODEL OF CARE FOR PATIENTS

In August 2017, IMH Central Region piloted the Yearly Dispensing Programme for patients with stable conditions. Enrolled patients would have follow-up appointments annually, instead of every six months. In between appointments, they would consult a pharmacist on the sixth month, as well as have two telephone consultations with case managers. As of March 2020, 114 patients enrolled in the Programme, and had benefitted from shorter consultation waiting time and lower costs.

With the support of allied health professionals, the Programme also optimised healthcare resources. IMH specialists were able to see more new patients with complex needs. IMH would be rolling out the programme across the hospital progressively.

TOP *Sedap Café* at IMH is a training venue for patients interested to work in the Food and Beverage sector.

HITTING THE NOTES OF RECOVERY

IMH first introduced music therapy as a pilot service at its Child and Adolescent Ward in FY2017. It eventually became part of the outpatient service in FY2018. In FY2019, music therapy was extended as a mainstream treatment option for patients with attention deficit hyperactive disorder, depression, and other conditions. About 65 per cent of patients who took part in the music therapy sessions reported feeling better after each session, and shared that the therapy was instrumental in their recovery.



MANAGING INFECTIOUS DISEASE OUTBREAKS

The National Centre for Infectious Diseases (NCID) was established in September 2019 to strengthen Singapore's capabilities in infectious disease prevention and management, and public health preparedness at the national level. The integration of clinical, research, and public health functions under NCID played a key role in the diagnosis and management of infectious diseases, enabling the Centre to respond swiftly in a proactive and coordinated manner. At the onset of an infectious disease outbreak, these following steps would be initiated:

- Isolation and containment of infectious cases
- Detection using laboratory diagnosis to confirm infected cases and to determine the strain/genotype of the pathogen
- Contact tracing to identify the close contacts of infected cases for quarantine
- Management of cases

BELOW Wards at NCID are designed for safety, efficiency, and flexibility.

MANAGING THE FIRST CASE OF MONKEYPOX VIRUS INFECTION IN SINGAPORE AND ASIA

In May 2019, Singapore confirmed its first imported case of monkeypox. A rare disease caused by a virus primarily transmitted to humans from animals, it occurs sporadically in parts of central and western Africa. The patient was a Nigerian man who was in Singapore to attend a conference. He was first seen at the TTSH ED before being admitted and isolated in a negative pressure room at NCID. Through a combination of astute clinical suspicion and rapid microbiologic diagnosis, NCID's National Public Health Laboratory (NPHL) confirmed the patient was infected with monkeypox in about 30 hours after he was admitted. This was done via polymerase chain reaction (PCR) and electron microscopy. Close contacts were subsequently reviewed and offered vaccination. The patient recovered and was discharged after receiving treatment.

MASS SCREENING AND VACCINATION FOR MEASLES

Measles is a highly contagious viral disease which affects susceptible individuals of all ages and remains one of the leading



Photo courtesy of Write Editions®



causes of death among young children globally. Despite the availability of a safe and effective vaccine, many countries around the world are experiencing measles outbreaks due to suboptimal vaccination coverage and population immunity gaps. Between June and July 2019, NCID managed measles outbreaks at three migrant worker dormitories, and a home for the intellectually disabled.

NCID's NPHL was involved in the detection of the measles virus and case diagnosis right at the start of the suspected outbreak. NPHL was able to identify the virus and confirm some of the infected cases by performing the necessary tests on all suspected cases. The information was then used by the clinical team to treat patients and contain the transmission. In addition, data collection and analysis by the Centre's National Public Health and Epidemiology Unit helped trace the close contacts of index cases. Working closely with MOH, NCID conducted ring vaccination for more than 2,000 close contacts between June and July 2019 to prevent further transmission. Over 600 of these close contacts of measles cases were screened and vaccinated at the NCID Screening Centre.



STRENGTHENING PRIMARY CARE SERVICES IN THE COMMUNITY

NHGP EXPANDS SUITE OF TELE-HEALTH SERVICES

Since 2005, the National Healthcare Group Polyclinics (NHGP) has offered tele-health services to patients. In line with the Government's move to tap on technology to connect safely with patients and to reduce the risk of transmission during the COVID-19 outbreak, NHGP ramped up its tele-health services in early 2020 for more patients:

- **Tele-Dietetics**

From March 2020, patients with chronic conditions, as well as paediatric patients with feeding and nutritional needs, were offered video consultations with NHGP dietitians. Besides convenience and time-savings for patients, Tele-Dietetics enabled dietitians to work closely with patients on individualised nutrition therapy through effective goal-setting and behaviour change. Through remote consultation, dietitians developed specific dietetic interventions that were practical in the patients' familiar environment.

- **Tele-Psychology**

Starting from February 2020, patients with existing psychologist appointments could opt for a tele-consultation with NHGP psychologists. This service provided essential mental health support and timely intervention on depression, anxiety, insomnia, or other stress-related problems for patients.



TRANSFORMATION OF PRIMARY HEALTHCARE LABORATORIES THROUGH THE USE OF TECHNOLOGY

NHG Diagnostics (NHGD) processed more than five million tests a year in its primary healthcare laboratories. Despite the increase in test loads year-on-year, NHGD delivered high-quality, accurate results. This was achieved through technology adoption, software customisation, and automation of processes. Key outcomes included:

- Efficient laboratory turnaround time of 60 minutes, which improved patient management and reduced the number of technical visits. Patients who required urgent attention were able to see their doctor and review their condition on the same day.
- Laboratory quality and standards, and report accuracy.
- Continuous laboratory productivity and learning opportunities to upskill staff.

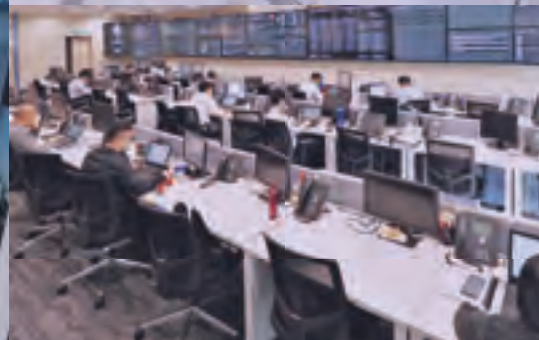


RESEARCH, INNOVATION & TECHNOLOGY



“ It is important we work with other clusters, medical schools, and hospitals to build a peak of research excellence in Singapore. Only when we do so are we able to translate research into innovations that impact and benefit patients’ health and outcomes.”

DR BENJAMIN SEET
DEPUTY GROUP CEO (EDUCATION AND RESEARCH), NHG



RESEARCH, INNOVATION & TECHNOLOGY

To facilitate the integration of technological innovations and evidence-based research in our population health journey, we continue to engage our patients and people, placing them first in whatever we do. Leveraging on the collective strength and intelligence of both humans and machines, we aim to enhance the performance of clinical care delivery systems, and improve the quality and safety of care, as well as promote patient empowerment and self-care.

COLLABORATION AND KNOWLEDGE EXCHANGE



SINGAPORE HEALTH AND BIOMEDICAL CONGRESS 2019

In October 2019, some 3,000 local and international health and social care professionals convened at the 17th Singapore Health and Biomedical Congress (SHBC) organised by NHG to draw inspiration, glean insights, and discuss topics centred on the theme of “Sustainable Healthcare through Innovation”. Nineteen specialty

tracks were featured, of which 10 were new, including Living with Frailty: Unravelling the Impact of Metabolic Diseases; Crisis & Complex Care; Empowerment through Digitalisation; Healthcare Finance Transformation; and Training Professionals for Tomorrow’s Healthcare.

Guest-of-Honour, former Senior Minister of State for Health and Second Minister for Law Mr Edwin Tong, witnessed the signing of a Memorandum of Understanding (MOU)

RIGHT NHG signed an MOU with NTU Singapore’s Lee Kong Chian School of Medicine to establish a Joint Programme for Translational Research.

between NHG and Nanyang Technological University, Singapore's (NTU Singapore) Lee Kong Chian School of Medicine (LKCMedicine) to establish a Joint Programme for Translational Research. Leveraging strategically on the expertise and resources of both partners, the collaboration will streamline the setting up of joint translational research centres to improve health outcomes in six areas: Ageing/Rehabilitation; Dermatology; Infectious Diseases; Mental Health; Metabolic-Vascular Diseases; and Population Health. The NHG Research Awards were also launched at the Congress.

The SHBC 2019 Scientific Competition attracted 611 submissions, and 53 awards across 16 categories were presented.

PRIMARY CARE FORUM 2019

National Healthcare Group Polyclinics (NHGP) held its 12th Primary Care Forum in conjunction with SHBC 2019. Themed *Primary Care: Innovative Communities, Co-Design for Quality*, the Forum highlighted the need for primary healthcare to go upstream to meaningfully tackle the social determinants of health early. Another topic explored how the consumer experience could be used as a factor in designing a patient-centred care delivery system. A General Practitioners (GP) Symposium to discuss clinical issues which GPs encounter in their day-to-day practice was also held.

BELOW The 12th Primary Care Forum held by NHGP highlighted the importance for primary healthcare to go upstream to tackle the social determinants of health early.



NHG RESEARCH AWARDS: OUTSTANDING RESEARCH IMPACT CATEGORY

The following projects were acknowledged as research which demonstrated a translational impact on healthcare provision nationally or internationally:

● **Familial Hypercholesterolaemia: Case Identification, Assessment And Reduction In Adverse Events (FHCARE)**

The ongoing study (2015-2021), led by a team comprising clinicians from Khoo Teck Puat Hospital (KTPH) and NHGP, resulted in the setting up of the first national registry for Familial Hypercholesterolaemia, a genetic disease which significantly increases the risk for premature cardiovascular disease. The study contributed to better care for affected individuals and deepened understanding of the long-term effects of treatments. Its findings also provided valuable data to guide decision-making by key stakeholders at various Singaporean, and international regulatory agencies.

● **Streptococcus Agalactiae (GBS) ST283 - A Regional Threat To Humans And Aquaculture**

This study (2016-2019) contributed significantly to the identification of the variant bacteria strain responsible for the deadly Yusheng blood poisoning outbreak in 2015. The sharing of its findings across hospitals in Singapore and subsequent joint efforts led to timely outbreak response by the Ministry of Health (MOH) and the former Agri-Food and Veterinary Authority of Singapore (AVA), which prevented more deaths. In addition, the team of clinicians from Tan Tock Seng Hospital (TTSH) and the National University of Singapore (NUS), also demonstrated that the same bacteria strain was responsible for causing severe diseases in farmed tilapia and humans across Southeast Asia over the past two decades. A novel test to screen for the outbreak variant in other affected countries was also developed.

● **Scientific Exploration, Translational Research, Operational Evaluation Of Disease Prevention And Preventative Measures Through New Treatment Strategies Against Dengue (STOP Dengue)**

Findings from the study (2005-2015) enabled the development of dengue test kits which drastically reduced diagnosis time from 24 hours to 30 minutes. The evidence resulted in new admission guidelines that effectively reduced inpatient admission for dengue at TTSH, and overall savings of S\$2.1m. The team of clinicians from the National Centre for Infectious Diseases (NCID), National Environment Agency (NEA), and Duke-NUS Medical School, also found intriguing convergence of dengue, ageing, and chronic diseases such as diabetes and hypertension. This would help raise Singapore's global role in future dengue research.



LEFT TTSH officially opened the P.H. Feng Research Centre (PHFRC) in November 2019, for the purpose of boosting the clinical research culture at the hospital through investigational medicine and clinical trials.

P.H. FENG RESEARCH CENTRE OFFICIALLY OPENS

TTSH officially opened the P.H. Feng Research Centre (PHFRC) in November 2019, for the purpose of boosting the clinical research culture at the hospital through investigational medicine and clinical trials. It was named in honour of the late Professor Feng Pao Hsui, widely recognised as Singapore's "Father of Rheumatology", who established Singapore's first Department of Rheumatology and Immunology at TTSH in 1995, and laid the groundwork for formal infectious disease training in Singapore. Located within HealthCity Novena Campus in NCID, PHFRC is sited close to the National Skin Centre (NSC), LKCMedicine, and TTSH. This promotes synergy and the optimisation of resources among the Institutions to bring about better research outcomes.

AAHRPP ACCREDITATION

The NHG Human Research Protection Programme successfully obtained re-accreditation by the U.S. Association for the Accreditation of Human Research Protection Programs (AAHRPP) in March 2020. The re-accreditation is valid for five years. It bears testament to NHG's rigorous standards for ethics, quality, and protection for human research.

HEALTH SERVICES AND OUTCOMES RESEARCH (HSOR)

Since its establishment in 2005, Health Services and Outcomes Research (HSOR) has provided the best available evidence to support NHG leadership and clinicians in decision-making. Emphasising holistic population health management, HSOR strives to deliver relevant and actionable research output that can help improve the quality and value of care delivered by NHG.

Here are some of HSOR's recent studies:

THE IMPACT OF A DIABETES PREVENTION PROGRAMME – A SIMULATION STUDY

Diabetes and its related complications pose pressing challenges to the sustainability of healthcare systems. Thus, policymakers, healthcare management, and clinicians alike, are keen to ascertain whether diabetes prevention programmes could be cost-effective or even save costs, especially in the long term. Using microsimulation, HSOR modelled the long-term progression of chronic diseases centred on diabetes, and evaluated the impact of a diabetes prevention programme on reducing disease prevalence and overall healthcare costs.

The construction of a microsimulation model: first, the team assembled a

synthetic Singapore population as a starting cohort; second, a Markov Chain Monte Carlo process was applied to model the process of ageing and disease progression at the individual level; and third, the impact of a diabetes prevention programme was simulated by considering the delay of onset of diabetes and related complications. Outcomes including disease prevalence, direct and indirect medical costs, and disability adjusted life years (DALYs) were used to quantify cost-effectiveness or cost-savings.

The microsimulation results showed that by intervening with a diabetes prevention programme, prevalence of diabetes, and diabetes with complications in 2050 is expected to be lower than that of 2016. The reductions are estimated to be from 20.1% to 16.3%, and 9.2% to 7.4%, respectively (Figure 1). Similarly, reductions are expected for direct and indirect medical costs, and DALYs for each simulated year (average direct medical costs: from S\$2.4k to S\$2.3k; average indirect medical costs: from S\$2.8k to S\$2.2k; and DALYs: from 112k to 95k).

These results indicate that diabetes prevention programmes are highly likely to be cost-effective or even cost-saving if the costs of the interventions are well-controlled.

THE ACUTE INTERNAL MEDICINE SERVICE EVALUATION – AN INTERIM EVALUATION

The Acute Internal Medicine Service (AIMS) at TTSH manages patients anticipated to require up to 72 hours of in-hospital care. AIMS involves early assessment by the General Medicine specialist, expedited investigations, and shortened time-to-intervention with allied health assessments, if required, to provide eligible patients earlier access to specialist care and management in the appropriate care setting.

HSOR performed an interim evaluation of the effectiveness of AIMS in reducing average length of stay (ALOS), and estimated the potential number of patient bed-days saved due to admissions to the unit. Patients admitted to the AIMS unit from November 2016 to January 2018 were compared with general ward patients who

FIGURE 1. RESULTS OF MICROSIMULATION

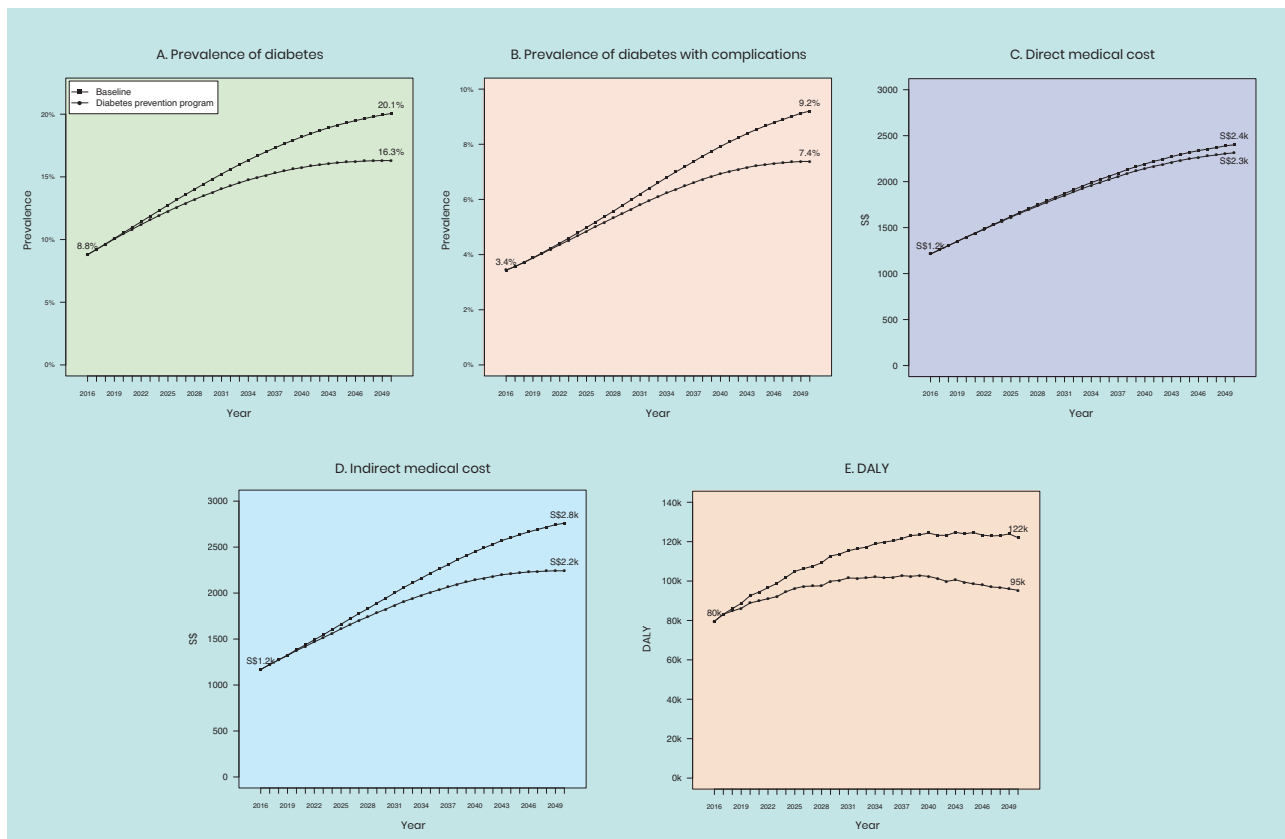
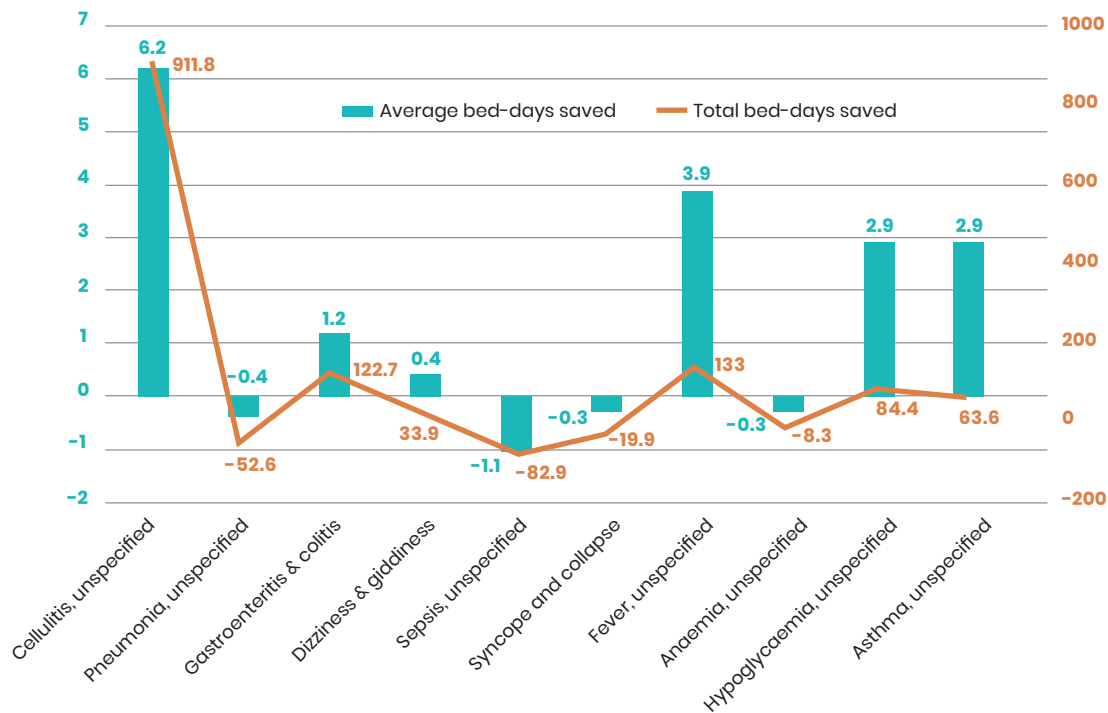


FIGURE 2. BED-DAYS SAVED, BY SPECIFIC ED DIAGNOSIS



would have been eligible for AIMS had it been in service before November 2016.

For the 10 most common AIMS patient diagnoses, 718 AIMS and 134 Control patients were studied. Adjusting for the differences in distribution of patient diagnoses, the overall weighted ALOS was more than 1.5 days longer for Control patients than for AIMS patients. Savings in bed-days were observed for six out of the 10 most common diagnoses (Figure 2). This difference in ALOS translated to savings of 1,186 bed-days for the hospital over a period of 15 months, even when restricted to the 10 most common diagnoses. Thus, despite a limited capacity of eight beds, AIMS may still potentially aid a hospital with high bed occupancy rates struggling with inpatient demand to preserve limited patient bed resources.

ASSOCIATION OF NUTRITIONAL STATUS WITH PHYSICAL FUNCTION AND DISABILITY IN OLDER COMMUNITY-DWELLING ADULTS – A LONGITUDINAL DATA ANALYSIS

In the older population, undernutrition has been found to be an important factor affecting their well-being in cross-sectional studies. However, little is known about how the duration of undernutrition or change in

nutritional status over a period of time affects physical function and disability in the elderly.

To find out more, HSOR conducted a study to investigate how changes in nutritional status are associated with physical function and disability among community-dwelling older adults. This was done using longitudinal data, or repeated observations of the same variables among the same group of older adults over a period of one year. In this study, the 18-item Mini Nutritional Assessment (MNA®) was used to evaluate nutritional status, and the Late-Life Function and Disability Instrument was used to assess physical function and disability. HSOR used data collected from 593 community-dwelling Central Region residents aged 60 years and older, who were part of a longitudinal population-based survey that resulted in a summated Population Health Index (PHI). The PHI defines an individual’s state of health, based on multiple dimensions of health.

It was found that compared to older adults with consistent normal nutritional levels, those who became undernourished or remained undernourished reported poorer physical function (B= -6.36 and -5.96, respectively; both p<0.01), and had less frequent involvement (B= -3.95 and -2.86,

respectively; both $p < 0.01$) and more limitation in performing life tasks ($B = -13.24$ and -16.02 , respectively; both $p < 0.01$) at 1-year of follow-up (Table 1). However, older adults with improved nutritional status did not differ in physical function and frequency of involvement in life tasks compared to those with normal nutrition.

Thus, undernutrition is associated with poorer physical function and disability in community-dwelling older adults regardless of whether it developed or was persistent over one year. Improving nutritional status could be an effective strategy to improve physical function in older adults.

“NHG focuses on developing technological enablers to aid healing, to address common and complex healthcare problems, to improve clinical processes, foster self-care, and encourage greater health ownership by both patients and staff in our Institutions, and people in the community.”

ASSOCIATE PROFESSOR THOMAS LEW
GROUP CHIEF DATA AND STRATEGY OFFICER, NHG

SMART SYSTEMS TO FUTURE-PROOF HEALTHCARE

NEXT GENERATION ELECTRONIC MEDICAL RECORDS (NGEMR)

The rise of chronic diseases and increasing demand for healthcare services will continue to grow exponentially and in time, the existing Electronic Medical Record (EMR) systems used by NHG would not be able to meet these challenges. Thus, NHG is currently working on the deployment of the Next Generation Electronic Medical Records (NGEMR), a joint project with MOH, Integrated Health Information Systems (IHIS), and National University Health System (NUHS).

The NGEMR will replace almost all the existing clinical systems in NHG and combine the different functionalities into a single platform. Being an integrated system, it will form the backbone for all our processes and workflows, and allow us to reach out to our population with our community and social sector partners. It will facilitate the sharing and exchange of information across NHG’s Institutions and our partners, and enable the use of data analytics and decision support to deliver better care. The NGEMR will also revolutionise and standardise the way healthcare staff collect patient and medical data, and how they access patient medical records.

TABLE 1. ASSOCIATION OF CHANGE IN NUTRITIONAL STATUS WITH PHYSICAL FUNCTION AND DISABILITY AT 1-YEAR FOLLOW-UP

Change in nutritional status	Physical Function			Frequency			Limitation		
	B	Std. Err	p	B	Std. Err.	p	B	Std. Err.	p
Remained normal	Reference category								
No longer undernourished	0.09	1.81	0.959	-0.99	0.91	0.278	-7.92	2.60	0.002
Became undernourished	-6.36	1.68	0.000	-3.95	0.85	0.000	-13.24	2.40	0.000
Remained undernourished	-5.96	1.87	0.002	-2.86	0.97	0.003	-16.02	2.68	0.000



For patients, tools and functionalities, like self-service appointment management, messaging, access to education materials, e-Check-In, and care plans that we hope to introduce would improve the patient journey and experience over time. There is much potential for patient empowerment and personalised care with the marrying of informatics and healthcare.

C3: SMART HOSPITAL FOR THE FUTURE

Developed by TTSH, IHIS, and ST Engineering, and supported by MOH, the state-of-the-art C3 (Command, Control & Communications) Smart Hospital System enhances the capability of the Operations Command Centre (OCC) located at the Ng Teng Fong Centre for Healthcare Innovation (CHI). C3 enables the OCC to shift resource management to flow management and autonomous responses effectively and seamlessly.

The system interacts with multiple ground sensors and transactional systems throughout the hospital in real-time, and brings together information that provides real-time visibility of ground operations, from optimisation of patient flow to resource management. It provides timely alerts to the management of issues encountered.

The C3 Smart Hospital System went "live" in December 2019 to support the daily operations of the Emergency Department and inpatient wards, and

was a key component in the hospital's fight against COVID-19. It won the Excellence Champion Medal at the 2020 National Healthcare Innovation and Productivity awards by MOH.

TOP The C3 interacts with multiple ground sensors and transactional systems throughout TTSH in real-time, and brings together information that provides real-time visibility of ground operations.

WHAT'S NGEMR:

- **Cross-institutional and discipline workflow integration** for true patient-centred care on population through data amalgamation and analysis to real-time actionable insights
- **Consolidated IT architecture** to provide the foundation for effective data and workflow exchanges with comprehensive functionalities to support different disciplines and job groups
- **Robust educational capabilities** to apply rich real-life patient data and scenarios for simulation and teaching across all care settings
- **Standardised tools/data sets** with centre-wide decision support capabilities for quality care and to realise value
- **Integration of clinical work with research and analytics** to reduce manual re-work, safeguard privacy of research subjects, and promote data collection and analysis
- **Ability to tap on communities of best practices** with easy-to-implement configuration and agility in localisation to accommodate evolving health needs
- **Use of technology** to promote patients' participation in their own care (such as a patient portal) through tele-monitoring, smart user interface with suggested information, etc
- **Flexible system** with capability to go beyond healthcare institutions to community and social sectors
- **Future-proof systems** that enable the provision of cutting-edge, next-generation medical care, including pharmacogenomics, personalised medicine, etc
- **Transition to holistic care** focusing on prevention and maintaining health, with clarity



“ Being in the thick of the COVID-19 crisis, NHG had opportunities to push new frontiers in research and technology.”

ASSOCIATE PROFESSOR TAN CHER HENG
DEPUTY CLINICAL DIRECTOR, CENTRE FOR HEALTHCARE INNOVATION

REAL-TIME LOCATION SYSTEM (RTLS)

In 2017, TTSH started the development of the Real-Time Location System (RTLS), which provided the foundational technology to track and locate persons and assets within the hospital in real-time.

RTLS was piloted as an IT innovation project at the National Centre for Infectious Diseases (NCID) in December 2019, enabling the tracking of patients, visitors, staff, and equipment, especially within the patient care areas. It also improved workflows.

Another important function of the system was to help monitor the hand hygiene of healthcare workers. Pressure sensors were placed under hand sanitisers and hand-wash dispensers. If healthcare workers did not complete the hand hygiene procedure before interacting with a patient, his/her RTLS staff tag would beep as a reminder.

With the success of the pilot, TTSH will be expanding RTLS to other premises in HealthCity Novena within the next few years.

INNOVATIVE INTERVENTIONS AND RESEARCH TO IMPROVE PATIENT CARE

NEW AI TOOL TO IMPROVE COVID-19 SCREENING

Radiologists from TTSH and researchers from the Agency for Science, Technology and Research's (A*STAR) Institute of High Performance Computing, and Institute for Infocomm Research, developed an artificial intelligence (AI) tool, RadiLogic, to swiftly detect abnormal chest X-rays during COVID-19 screening at NCID. Programmed through deep learning, RadiLogic was fed with 1,000 anonymised abnormal chest X-rays from COVID-19 patients and 4,000 anonymised normal chest X-rays to train it to identify pneumonia accurately.

RadiLogic analyses each X-ray image within three seconds and highlights abnormal chest X-rays quickly, which helps radiologists prioritise which images to review. As such, radiologists could report such cases in about 50 minutes, after each patient completes the procedure. Previously, each X-ray image was reviewed by a radiologist within an hour, and had to be analysed in sequence, which was time-consuming. Efforts are



being made to enhance the tool's AI capabilities, such as:

- Training the system to distinguish between COVID-19 pneumonia and other types of lung infection
- Targeting abnormal regions and indicate the probability of pneumonia

RadiLogic has an accuracy of up to 96.1%, and was deployed in the NCID Screening Centre in May 2020.

3D PRINTING AT TTSH FOOT CARE AND LIMB DESIGN CENTRE

The introduction of 3D scanning and printing technology in 2018 at the TTSH Foot Care and Limb Design Centre (FLC) has reduced waiting times for patients who require customised ankle-foot orthotic braces. They now receive one, in just one to four weeks, an improvement from 12 weeks previously. TTSH was the first hospital in Singapore to offer medical-grade 3D printing of customised orthoses for patients.

The new method involves the use of handheld scanners and 3D software.



LEFT The TTSH Foot Care and Limb Design Centre uses handheld scanners and 3D software to create customised ankle-foot orthotic braces.

Once a design is finalised, it is sent to a local 3D-printing company that creates the brace with a special plastic that can be customised to balance flexibility, durability, and strength. This has saved manpower costs for fabrication, reduced material wastage, and shortened the turnaround time for delivery. This initiative won the Best Practice Medal at the 2019 National Healthcare Innovation & Productivity awards by MOH.

The innovation paved the way for technicians to learn new skills in clinical management, while podiatry assistants took on more complex tasks from the podiatrists, and the prosthetists/orthotists gleaned new knowledge and skill in product design and computer modelling.

PRESAGE: A SMART BED-EXIT PREDICTION AND PREVENTION SYSTEM BASED ON THERMAL SENSING

Co-developed by TTSH, PreSAGE is a bed surveillance and prevention prediction system that uses thermal sensing to provide round-the-clock automated surveillance for high fall-risk patients. Trained on 12,000 hours of real patient thermal data, PreSAGE provides accurate early warning based on machine learning models. The alarm triggers whenever a positive bed-exit is predicted, disarms automatically when a nurse is at bedside, and rearms again when the patient is alone.

PreSAGE was deployed in TTSH's general wards in September 2019. Studies on it showed 99.7% sensitivity and 100% specificity. As the system required minimal

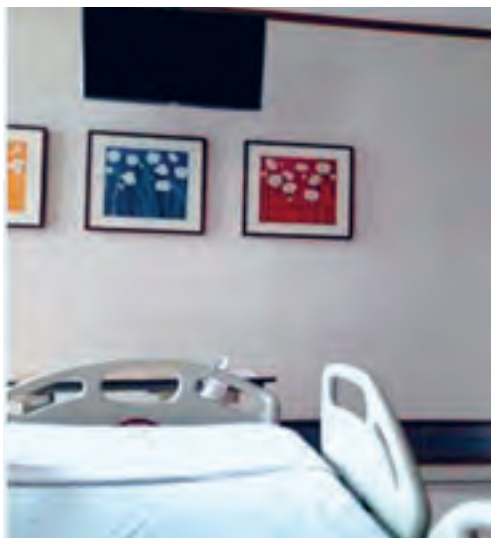
maintenance and was easy to set up, it was projected to save up to 30% nursing full-time equivalents (FTEs) in falls prevention surveillance. This directly translated to safer care for patients, fewer false alarms, better nursing productivity, and improved staff morale. The project clinched the HIMMS-Elsevier (Asia Pacific) Outstanding Innovation Award 2019.

BREAKTHROUGH RESEARCH REVEALS WIDESPREAD PRESENCE OF GBS ST283 DISEASE ACROSS SOUTH-EAST ASIA

An outbreak of blood poisoning borne of fish happened in Singapore in 2015. Over 160 people were admitted to hospital with fever, and invasive infections such as septic arthritis and meningitis, after consuming raw freshwater fish. Researchers at TTSH subsequently identified the group B *Streptococcus* (GBS) bacteria that caused the illness as a strain called "ST283".

A network of 30 collaborators led by TTSH discovered that the GBS ST283 disease was more widespread than believed, and had affected humans and farmed fish (aquaculture) across South-east Asia for decades. Published in the journal *PLoS Neglected Tropical Diseases*, the study revealed that GBS ST283 caused a chronic regional outbreak, and was undetected due to underdeveloped surveillance systems in "One Health", a concept that encompasses humans, animals, and the environment. The research was the first of its kind investigating the regional prevalence of GBS ST283.

TTSH is currently working with A*STAR's Genome Institute of Singapore, and its international research team, to determine the origin of ST283, its geographical extent, transmission, and pathogenicity to help curb the disease. The Food and Agriculture Organization of the United Nations is also in the process of entering into an agreement with TTSH to lead an international review of the data.



OPTICAL COHERENCE TOMOGRAPHY STUDY

In 2019, the National Skin Centre (NSC) applied in vivo ("live") non-invasive skin imaging to identify the mechanism of individuals who were not able to sweat (hypohidrosis). To-date, the condition is idiopathic (no known cause/mechanism), has no effective treatment, and is incurable. NSC's discovery, however, has enabled effective and curative treatment for this potentially fatal condition to be instituted. A patent has been filed for this treatment approach, and a study conducted on the topic has been accepted for publication by the *European Journal of Dermatology*.



TOP A/Prof Edwin Seet, Clinical Director, Office of Clinical Governance, Yishun Health, was the lead investigator of the Singapore cohort study on OSA.

BOTTOM RIGHT Medi-Box features secure and temperature-controlled lockers that ensure medications are properly stored at all times.

SEVERE UNRECOGNISED OBSTRUCTIVE SLEEP APNOEA PUTS SURGICAL PATIENTS AT RISK OF ADVERSE CARDIOVASCULAR OUTCOMES

People with obstructive sleep apnoea (OSA) have breathing that stops repeatedly during sleep due to their throat muscles relaxing intermittently and blocking their upper airway. Long-term population studies have demonstrated that OSA is associated with an increased risk of myocardial ischemia, heart failure, stroke, and even death. It is uncertain if undiagnosed OSA affects outcomes during the 30-day period after surgery.

In this prospective multinational cohort study, more than 1,200 patients were recruited from eight hospitals across five countries between January 2012 and July 2017, with follow-up appointments until August 2017. KTPH was one of the hospitals involved in the study. Patients aged 45 and above with at least one cardiac risk factor without prior diagnosis of sleep apnoea and undergoing major non-cardiac surgery were recruited. A preoperative sleep study was performed to determine if these patients had unrecognised OSA. Postoperative monitoring included nocturnal pulse oximetry and measurement of cardiac troponin concentrations.

It was found that the rate of a composite outcome of postoperative cardiovascular events (myocardial injury, cardiac death, congestive heart failure,

thromboembolism, atrial fibrillation, and stroke) among those with OSA versus no OSA was 21.7% vs 14.2% – a difference that was statistically significant. However, the difference was marked only for the subgroup with severe OSA. Another novel aspect discovered was that low oxygen saturation (less than 80%) after the operation predicted adverse outcomes.

The study suggested that severe unrecognised OSA put surgical patients at risk of adverse cardiovascular outcomes, and 30-day mortality. Further research would be needed to assess whether interventions could modify this risk.

CONVENIENT MEDICATION PICK-UP WITH MEDI-BOX

Medi-Box is a fast, convenient, and simple method of collecting medications from the KTPH Outpatient Pharmacy (OP). Introduced in July 2019, it featured secure and temperature-controlled lockers that could ensure medications were properly stored at all times. Patients and staff could place medication orders with the OP through various channels, including a phone call and the KTPH website, or through the HealthHub mobile app. They could collect their medication from assigned lockers after one working day, for up to 48 hours. There are 72 lockers available, 12 of which have refrigeration for storing special medications such as insulin. Medi-Box offers four language options (English, Mandarin, Malay, and Tamil). A brochure to guide patients on its use is available.



HAND MITTENS TO KEEP PATIENTS SAFE

TTSH nurses from Ward 5A designed a special pair of mittens for patients with dementia and delirium. As some mental health conditions can often cause patients to become agitated or restless, resulting in them pulling out their tubes and catheters, the cushioned and zip-fastened hand mittens allow patients to still move their fingers while keeping them safe. Feedback from patients' caregivers has been positive.

BOOSTING POPULATION HEALTH

STANDARDISED DRUG-RELATED PROBLEM (DRP) CLASSIFICATION GRID

Since January 2019, NHG has led a cross-cluster project with the NUHS to develop a classification grid to document DRPs effectively and efficiently. Proper documentation provides a rich source of data to feed predictive modelling in identifying patients at risk of DRPs, and could be used to demonstrate the value of pharmacists' contributions to patient care. The joint team tested the usability and robustness of the proposed DRP classification grid in various settings. This standardised DRP classification grid has been incorporated into the future prescribing systems of both NHG and NUHS clusters to facilitate DRP documentation. It would be continuously refined and improved, based on feedback.

LOCAL VALIDATION OF DOSE-NONADHERENCE TOOL

Various studies have shown that poor adherence by patients to appropriate medication therapy can result in complications, death, and increased healthcare costs. To address this issue, various NHG Institutions – TTSH, KTPH, NHG Pharmacy (NHGPh), and Admiralty Medical Centre (AdMC) – joined hands with Singapore General Hospital (SGH) and Duke-NUS Medical School in April 2018 to embark on a large-scale study to validate a medication adherence screening and assessment tool (DOSE-Nonadherence Tool). The research was approved by the NHG Domain Specific Review Board (DSRB), and the results of the study were published in the *Patient Preference and Adherence* journal in June 2019.

The locally-validated tool is currently being tested in various clinical projects led by pharmacists to screen and assess patients' medication adherence. Patients who need help in managing their medicines are identified, and are supported to achieve better outcomes from their medication therapy.

SUPPORTING FAMILY CAREGIVERS OF OLDER ADULTS

The TTSH Nursing team spearheaded several initiatives to bolster support for caregivers of the elderly:

- **Research on Caregiver Mastery and Well-being**

A nurse-led multidisciplinary research study on family caregivers of the elderly inpatients revealed that one in three caregivers was at risk of caregiver burden and depression. Conducted between 2015 and 2017, it highlighted the importance of boosting caregiver mastery and the need for greater support for caregivers' psychological and emotional well-being. The study also showed that caregivers' sense of mastery, or control over their lives, could possibly reduce the effect of caregiver burden and risk of depression. These findings have been used to develop a caregiver-centric screening tool for caregivers of elderly patients and the establishment of a caregiver support programme in TTSH.

- **Development of Caregiver-centric Screening Tool**

The Nursing team developed a caregiver-centric screening tool in early 2019, incorporating both protective and risk



Screen & Assess



Identify Needs



Training & Support

factors, for the early identification and provision of appropriate assistance to at-risk family caregivers of hospitalised care-dependent older adults. It is the first of its kind to integrate and construct caregiver mastery with caregiver burden and relevant caregiver characteristics taken into consideration, and piloted as part of the caregiver support process for dementia patients.

● **Psychotherapeutic Caregiver Intervention for Families of People with Dementia**

Under the 2019 Health Manpower Development Programme (HMDP) training award, two experts from Sinai Health System (Canada) were engaged to train the team on a therapeutic and psycho-educational programme for caregivers. It included psychotherapeutic and simulated patient techniques that targeted the caregivers' emotional responses and coping ability. In October 2019, the team successfully delivered the evidence-based programme at TTSH, a first in an Asian setting. Caregivers shared that the programme taught them to 'focus on the core of the problem'.

USING TECHNOLOGY TO PREDICT HEALTH OUTCOMES IN PATIENTS WITH SCHIZOPHRENIA

The Research Division in the Institute of Mental Health (IMH) is collaborating with the MOH Office for Healthcare Transformation (MOHT) to conduct a study titled *Health Outcomes via Positive Engagement in Schizophrenia*. Participants diagnosed with schizophrenia spectrum disorders have been recruited for the study since November 2019. Upon individual consent, passive digital data is then collected from their smartphones and wrist wearable devices for a 24-week period. This includes information related to sleep patterns, heart rate, physical activity, phone usage patterns, and ambient light. The data would be used to build an algorithm capable of monitoring mental health and predicting adverse clinical events, such as relapse and readmission. Expected to conclude in 2022, the study aims to shed light on the relationship between digital biomarkers with clinical status and health utilisation outcomes, as well as explore the feasibility and acceptability of digital sensors.



NSC SETS UP ATOPIC DERMATITIS DATABASE

The National Skin Centre (NSC) set up the Atopic Dermatitis Database in November 2019 to collect biological material and clinical data through scientific studies. The database captures high quality, comprehensive, longitudinal clinical data on the epidemiology, clinical features, management, and outcome measures of the disease. Biological material amassed facilitates genetic and laboratory-based research to understand underlying genetic risk factors and pathomechanisms. This information enables NSC to perform key phenotype-genotype correlations, and identify new genetic and laboratory biomarkers to prognosticate and guide treatment of the condition.

IMH RESEARCH ON SCHIZOPHRENIA WINS ELLIOT GERSON PAPER OF THE YEAR AWARD 2019

Dr Max Lam Zhan Yang, Research Fellow, IMH and his team were bestowed the Elliot Gershon Paper of the Year Award 2019 at the World Congress of Psychiatric Genetics for their research on comparative genetic architectures of schizophrenia in East Asian and European populations. The project is a first in researching the genetic structures of the disease across ancestries. It is based on data of around 60,000 participants of Asian ancestry where similar genes associated with the risk of schizophrenia between East Asian and European ancestries were identified. New advanced statistical methods were also developed for the purpose of this study.

WORKFORCE TRANSFORMATION AND INCREASING PRODUCTIVITY

DEVELOPMENT OF CLINICIAN-SCIENTISTS

NHG offers a comprehensive research talent development roadmap that supports clinicians at different stages of their careers to become Clinician-Scientists (CSs). Programmes such as the Clinician-Scientist Preparatory Programme (CSPP), Clinician-Scientist Fellowship (CSF), and the Clinician-Scientist Career Scheme (CSCS), are jointly funded and managed with NHG's academic partner, LKCMedicine, under the Joint Programme for CS Development. As of end-FY2019, there were 47 CSPP awardees, 19 CSCS awardees, and 17 CSF awardees.

STREAMLINING ONLINE PHARMACY OPERATIONS

Launched in May 2012, NHG Pharmacy Online sales doubled between FY2016 and FY2019. To increase capacity and ensure room for further growth, the marketing, operations, and buying teams embarked on centralising the online order fulfilment process at Yishun Pharmacy. In October 2019, the Yishun Pharmacy Online Fulfilment Centre began operations. This streamlined stock management and improved oversight of online sales and trends.

CENTRALISING WAREHOUSING AND DISTRIBUTION SERVICES

In line with the national plan to streamline procurement and supply chain services for public healthcare institutions under ALPS, Zuellig Pharma was appointed as the third-party logistics service provider to support centralised warehousing and distribution services. The mammoth task of planning and executing warehouse migration activities started in July 2019 and involved functional teams from IHIS, IBM,

ALPS, Zuellig Pharma, NHGPh, NHGP, and NHG Diagnostics (NHGD). The collective effort resulted in successful migration by October 2019.

CUSTOM-DESIGNED SPECIALIST OUTPATIENT CLINICS AT WHC

Specialist Outpatient Clinics (SOCs) at the Woodlands Health Campus (WHC) are designed to provide patients with more service options. The WHC team adopted a design-thinking approach towards the transformation of the SOC, which involved engaging users as a first step. This included conducting workshops, interviews, and mock-up trials with patients as well as WHC staff to understand their experiences, and to highlight issues which could be addressed through better design. Findings were applied in the brainstorming and design phases to create possible solutions for testing.

This collaborative initiative led to the setting up of self-service stations and a mobile application to enable most patients to navigate through the clinics with ease. They were able to book, cancel, or reschedule appointments at their fingertips. WHC is also looking at cashless payments and self-service financial counselling for simple procedures to reduce unnecessary waiting for patients.

DENTAL STERILISATION AND ORGANISATION FOR RECALL AND TRACEABILITY (DSORT)

A project involving KTPH's Department of Dentistry, Central Sterile Supply Department, Facilities, and IHIS was undertaken from July to December 2019 to address the need for a system to record the sterility of instruments, trace instruments, and



track their usage to the specific patient. The initiative consisted of revamping and improving the instrument reprocessing infrastructure to separate the “dirty” and “clean” areas; creating an inventory to label every instrument with a unique identifier; and developing a software to track instruments, sterility expiry dates, and an automated system-wide recall of non-sterile instruments.

This resulted in a well-defined workflow with staff taking on clear and specific responsibilities. Harnessing technology, the electronic detection of non-sterile instruments before use is a fail-safe system, thereby providing staff with peace of mind. By reducing the potential for human error, patient safety improved.

IMPLEMENTATION OF PRE-ANALYTICS SYSTEM TO AUTOMATE LABORATORY PROCESSES

NHGD launched a pre-analytics system at its laboratory at IMH in January 2020. The system enabled the full automation of laboratory processes for biochemistry and immunoassay which cover more than 80% of the work. The automation removed the manual and repetitive processes of centrifugation, uncapping, and recapping, and allowed staff to do more value-add activities such as quality assurance and expanding laboratory capacity.



RIS/PACS IT CONNECTIVITY ON BOARD MOBILE X-RAY TRAILERS

During the COVID-19 pandemic, NHGD Mobile X-ray (MX) trailers I and II were deployed to the Community Care Facilities (CCFs) at Singapore Expo and Tuas South, respectively.

To enable the seamless transfer of X-ray images, a secured wireless



VPN LTE (SIM card) network was implemented, enabling the RIS (Radiology Information System) / PACS (Picture Archiving and Communications System) to function in similar ways to a polyclinic setting. This removed the need for radiographers to manually toggle the system to send X-ray images, which could cause potential delays in treatment. Images and radiology reports are now available electronically on CPACS (Cluster Picture Archiving and Communications System) and NEHR (National Electronic Health Records) within one hour. The quick turnaround time and on-site convenience improved patient management and care.

USING FORMSG TO IMPROVE TRACKING OF MEDICAL COURIER CONSIGNMENTS

In March 2020, NHGD introduced the use of FormSG that enabled its medical couriers to upload acknowledged consignment notes of completed jobs on the go. It facilitated the need to track critical and/or urgent deliveries remotely by job requesters, and staff, amid the COVID-19 pandemic. Besides improving service, the implemented FormSG helped to boost NHGD’s productivity, and security of documents. FormSG is a secured solution provided by GovTech for public healthcare.

UPGRADING OF NHGD LABORATORIES FOR ENHANCED SECURITY AND NGEMR

In February 2020, the Laboratory Information System (LIS) used at NHGD laboratories in 10 polyclinics, IMH, and Ang Mo Kio – Thye Hua Kwan Hospital, was upgraded from TD-Synergy to TDNexLabs (TDNL). The system upgrade resulted in better user interface and enhanced security features. It would be linked directly to EPIC and support the automation of several processes as part of the NGEMR when it is officially launched.

TOP NHGD Mobile X-ray (MX) trailers I and II deployed to the Community Care Facilities (CCFs) at Singapore Expo and Tuas South improved patient management and care.

EDUCATION



“ No matter how good our plans are, they boil down to the quality of the individuals who have to carry them out. During the COVID-19 pandemic, the resilience and commitment of our educators shone through, as they made the necessary shifts to ensure that learning continued. In fact, the crisis greatly accelerated the adoption of digital technologies for teaching and training.”

DR BENJAMIN SEET
DEPUTY GROUP CEO (EDUCATION AND RESEARCH), NHG



EDUCATION

Education is a critical pillar in NHG's multi-faceted strategy to cultivate a sustainable healthcare system. It is committed to building a resilient, future-ready, and versatile workforce capable of operating cross-functionally in various care settings so that our patients can receive quality care wherever they seek it.

NURTURING THE HEALTHCARE PROFESSIONALS OF TOMORROW

LKCMEDICINE WHITE COAT CEREMONY 2020

In August 2020, Nanyang Technological University, Singapore's (NTU Singapore) Lee Kong Chian School of Medicine (LKCMedicine) inducted its eighth cohort at the *White Coat Ceremony*. The ceremony, which symbolises the start of the students' medical journey, was held in a hybrid physical-virtual mode in line with COVID-19 guidelines. Professor Chee Yam Cheng, President of Singapore Medical Council and Senior Advisor of NHG, was the Guest-of-Honour for the event. Together with Prof Chee, NTU President Professor Subra Suresh, LKCMedicine Governing Board Chairman Mr Lim Chuan Poh, NHG Deputy Group CEO (Education and Research) Dr Benjamin Seet, Dean of LKCMedicine Professor James Best, LKCMedicine Vice-Deans and Chief Operating Officer were at each of LKCMedicine's five House venues to witness the students' donning of White Coats and reciting of the *Declaration of a New Medical Student*.

INAUGURAL COHORT FOR GRADUATE DIPLOMA IN SPORTS MEDICINE (GDSM) GRADUATES

The inaugural cohort of LKCMedicine's *Graduate Diploma in Sports Medicine (GDSM)* programme graduated in August 2019. Launched in March 2018, the programme trains doctors to manage sports-related injuries and offer medical support for sports events.

ENHANCING MENTAL HEALTH COMPETENCIES IN PRIMARY CARE

In April 2019, the eighth *Graduate Diploma in Mental Health (GDMH)* cohort graduated, with 15 doctors from private practice, polyclinics, and hospitals. This brings the total number of GDMH-trained doctors in Singapore to 142 since the programme's launch in 2010. The GDMH is jointly offered by the Institute of Mental Health (IMH) and the Division of Graduate Medical Studies at the National University of Singapore (NUS) to develop a network of General Practitioners (GPs) to manage psychiatric conditions. A new module on Personality Disorders and Psychological Therapies was offered in September 2019.



BELOW The inaugural cohort of LKCMedicine's Graduate Diploma in Sports Medicine (GDSM) equips doctors to manage sports-related injuries.





TOP LEFT & RIGHT
LKCmedicine inducted its eighth cohort at the White Coat Ceremony, held in a unique hybrid physical-virtual mode.

RIGHT The eighth Graduate Diploma in Mental Health (GDMH) cohort expanded the network of GPs equipped to manage psychiatric conditions.



“Providing a conducive growth environment for medical Residents is key to their development. This includes creating opportunities for Residents to be engaged in work-based learning while safeguarding their psychological safety and wellness.”

DR FAITH CHIA
DESIGNATED INSTITUTIONAL OFFICIAL (DIO), NHG RESIDENCY



PIONEERING BATCH OF THE ADVANCED DIPLOMA IN PHARMACEUTICAL SCIENCE

NHG Pharmacy’s (NHGPh) first cohort of Pharmacy Technicians (PTs) from the 18-month structured *Advanced Diploma in Pharmaceutical Science* programme graduated in May 2019. Co-developed by Nanyang Polytechnic (NP) and the Ministry of Health (MOH) Pharmacy Technicians Training & Development Committee, graduates were encouraged to take on more roles, as well as build and enhance their competencies for higher-level job functions. They included more advanced roles such as co-leading improvement projects, providing Warfarin Counselling, and leading in inventory management as well as performing audits and evaluating the results.



LEADERSHIP CHANGES AT LKCMEDICINE

Dr Serene Ng became Chief Operating Officer (COO) of LKCmedicine in January 2020, succeeding Mr Chan Wei Chuen. Dr Ng was previously the Director of the Office of Administration, NTU Singapore, where she played a vital role in streamlining processes to boost operational efficiency. As the new COO, Dr Ng works closely with the Dean of LKCmedicine to drive institutional initiatives that enhance faculty affairs, as well as education and research governance and development.



INAUGURAL KTPH BASIC SURGICAL SKILLS WORKSHOP LAUNCHED

In December 2019, NHG Group Education and Khoo Teck Puat Hospital (KTPH) co-organised the inaugural *KTPH Basic Surgical Skills Workshop*. It was attended by about 30 medical students from the Singapore Medical Society of Australia and New Zealand, LKCMedicine, and NUS Yong Loo Lin School of Medicine. Taught by faculty and residents from the KTPH Department of Surgery, the workshop strengthened students' clinical learning experience with theory and practical training in basic suturing techniques, laparoscopy, and endoscopy.

PRACTISING THE PRINCIPLE OF CONTINUOUS LEARNING

EMBRACING DIGITAL PLATFORMS FOR CONTINUAL LEARNING

In FY2019, NHG and its Institutions adopted more innovative digital models of learning – on-demand and on-the-go – to equip healthcare professionals to continually upgrade themselves.

- In September 2019, Tan Tock Seng Hospital (TTSH) launched the *ULeap* micro-learning platform, which offers bite-sized modules for staff. This enabled workforce transformation through a social mode of learning.
- As part of Yishun Health's digitalisation efforts – one of its strategic training thrusts – a basic Digital Literacy workshop with modular programmes on Smart Healthcare was organised for staff in FY2019. Yishun Health partnered the National Library Board (NLB) to set up *e-Reads @ Yishun Health* – an online service available on a Touchscreen PC,



COMMUNITY ENGAGEMENT: LKCMEDICINE GIFTS COVID-19 CARE PACKAGES TO FRONTLINE NHG STAFF

In March 2020, Professor James Best, Dean, LKCMedicine and Dr Serene Ng, COO, LKCMedicine presented special care packages to Professor Eugene Fidelis Soh, CEO, TTSH & Central Health, and Associate Professor Chin Jing Jih, Chairman Medical Board, TTSH & Central Health. The packages were distributed to NHG frontline staff in appreciation of their COVID-19 contributions. A card signed by the medical school's core leadership team accompanied the packages, along with 50 LKCMedicine teddy bears donning purple scrubs.

ABOVE Some 30 medical students, who attended the inaugural KTPH Basic Surgical Skills Workshop, developed clinical learning experience through theory and practical training.

located at KTPH's Auditorium Foyer – where staff could tap, browse, and borrow from a curated book collection. Other learning technology workshops included a micro-course development, and e-course design and development programmes for educators and trainers. A Yishun Health Clinicians' Course Tracking (CCT) portal was also launched for clinicians and Heads-of-Department to browse core and compulsory courses and view key training hours for their units. The in-house customised portal aggregated data from various online learning systems, and provided a one-stop access portal for the easy viewing of course records.

- In June 2019, Woodlands Health Campus (WHC) adopted and implemented the Civil Service College's (CSC) digital learning platform, *LEARN*, to enhance employees' learning through CSC's proprietary courses and curated content from third-party providers. Topics ranged from leadership and supervision, to problem-solving and design thinking.

RAISING MENTAL HEALTH LITERACY IN THE COMMUNITY

In FY2019, IMH provided professionals, patients, caregivers, and the public with information on how best to manage mental health conditions in the community.

- In July 2019, IMH guided over 120 members of the public on overcoming depression in middle age and mid-life transitions through its *Coping with Transitions* forum.
- IMH's Mood Disorders Unit (MDU) organised an inaugural learning event for various medical and social professionals in August 2019. The event, attended by 200 participants from healthcare and social care organisations, provided updates on treatment and intervention in mood disorders, such as depression and bipolar disorder.
- In August 2019, IMH partnered OCD Network Singapore and Clarity Singapore to co-host a sharing session, *Sharing of OCD Experiences*, where five patients shared their personal recovery stories with 130 caregivers. In October 2019, IMH partnered the same organisations to host the first *OCD Carnival Day* to commemorate World OCD Awareness Week. It was attended by over 100 clients and their families.

“COVID-19 brought out the indomitable spirit of our educators to ensure staff received continual training amid the pandemic. Their collective leadership and dedication played a role in shaping the future of Singapore's healthcare workforce and the health of our population.”

ASSOCIATE PROFESSOR NICHOLAS CHEW
GROUP CHIEF EDUCATION OFFICER, NHG
& CHAIRMAN MEDICAL BOARD, WHC

IMPROVING PATIENT ENGAGEMENT

In FY2019, the NHG Family conducted several patient-engagement training programmes and seminars to improve the relationship and rapport between healthcare providers and their patients:

- In December 2019, a cluster-wide *Tell Me 3* campaign was launched across NHG Institutions to prompt patients to highlight any recent admissions, doctor visits, and medication changes during their doctor/pharmacist consultations to facilitate better care. This campaign involved displaying posters and e-posters at all outpatient waiting areas. Internally, a *Show U-CARE* campaign was launched to inform doctors and pharmacists on appropriate responses when patients informed them about changes in their care.
- In July 2019, NHGPh piloted a 12-week health literacy training curriculum, *Communicating Healthcare Information Understandably – as Easy as ABC (CHIO-ABC)*, to help staff better convey medication information to patients. The curriculum, which incorporated National Healthcare Group Polyclinics' (NHGP) health literacy principles (CARPET), was customised by NHGPh to teach effective communication skills among pharmacy staff. A survey on CHIO-ABC reported that 86 per cent of staff found the curriculum enjoyable, while over 90 per cent found it relevant and applied the skills to their interactions with patients.



TOP A clusterwide *Tell Me 3* campaign was launched to prompt patients to highlight recent medical history during clinical consultations to facilitate better care.



ASEAN DENGUE DAY

In June 2019, the National Centre for Infectious Diseases (NCID) organised the annual *ASEAN Dengue Day* seminar to impart knowledge and best confidence in Primary Care physicians to manage dengue in the community. Over 370 participants attended the seminar, including GPs, nurses, and Allied Health Professionals (AHPs). In addition, NCID organised a media briefing on the management of dengue in Singapore. Professor Leo Yee Sin, Executive Director of NCID, was among the panel of experts.

INAUGURAL SINGAPORE HIV CONGRESS

In November 2019, NCID, Ng Teng Fong Centre for Healthcare Innovation (CHI), Changi General Hospital (CGH), National University Hospital (NUH), Singapore General Hospital (SGH), and TTSH jointly organised the inaugural *Singapore HIV Congress*. It brought together the medical, scientific, and academic fraternity to discuss and provide updates on the state of antiretroviral therapy (ART) in HIV treatment and related fields. The Congress was attended by over 260 participants.

TOP Dietitians outreach in the community



“What kept me awake? Trying to figure out how to stay a few steps ahead of the outbreak, instead of chasing it. What kept me going? The drive of the people around me, who came together as a team despite coming from different parts of NHG.”

DR BENJAMIN SEET
DEPUTY GROUP CEO (EDUCATION AND RESEARCH), NHG

INVESTING IN OUR LEADERS AND EDUCATORS

ENABLING COLLECTIVE LEADERSHIP ACROSS THE NHG FAMILY

- From August 2018 to July 2019, NHG College launched the *NHG Collective Leadership Conversations* for more than 440 leaders across NHG Institutions, ranging from Group Chiefs to Directors and Clinicians. Participants gained insights on building more meaningful relationships with peers and staff. Additionally, two *Train-the-Facilitator* runs were conducted to build up the cluster's pool of facilitators involved in delivering the programme for staff across Institutions.

- Since May 2019, NHG has organised internally-facilitated runs of the *Collective Leadership workshops* for managers and team leaders, attended by over 300 participants from diverse backgrounds in the organisation. As Collective Leadership is central to NHG's success and mission, and during crises, these workshops would be rolled out to more staff.

ENHANCING FACULTY DEVELOPMENT

In FY2019, NHG College delivered 52 faculty development programmes, training over 1,900 educators and faculty members to deliver quality health professions education.



THIS PAGE More than 440 leaders across NHG Institutions participated in *NHG's Collective Leadership Conversations* – especially critical during COVID-19.





NHG GROUP EDUCATION CELEBRATES ITS 10TH ANNIVERSARY

NHG Group Education celebrates its 10th Anniversary in 2020. To mark the milestone, it introduced a new vision statement, *Inspiring Professionals, Imagining Tomorrow, and Re-inventing Healthcare*, to chart the future of health professions education in NHG. Underpinning these efforts is a new framework, *Professionals for Tomorrow's Healthcare (PTH)*, to identify the essential attributes and competencies such as systems thinking, teamwork, future-oriented thinking, distributed leadership, and ethos, which are vital for healthcare professionals operating in an ever-evolving healthcare landscape.

NHG College now offers 27 faculty development programmes, which cover a variety of skill sets, such as designing and planning, teaching and facilitating, assessment of learning, and educational management and research.

To enable NHG educators to adapt to new teaching methods, including the use of technology, during the COVID-19 pandemic, NHG College embarked on a webinar series on *Health Professions Education during an Outbreak*. Three webinars were conducted from May to July 2020.

NEW TRAINING CURRICULUM FOR NHG'S REVISED OPEN DISCLOSURE POLICY

From FY2018 – 2019, NHG Group Quality and Clinical Governance (GQCG) rolled out a new training curriculum for its revised *Open Disclosure Policy*, enhanced to improve a culture of patient safety for physicians, nurses, AHPs, and administrators. This train-the-trainers process helped boost training capacity and capabilities across all NHG Institutions.

GLOBAL PARTNERSHIPS IN KNOWLEDGE EXCHANGE

NTU/LKCMEDICINE PARTNERS WHO TO IMPROVE DIGITAL HEALTH AND EDUCATION

In June 2019, the Centre for Population Health Sciences (CePHaS), hosted by LKCMedicine, was designated the World Health Organization’s (WHO) first Collaborating Centre for Digital Health and Health Education. The four-year partnership paves the way for CePHaS to implement a series of activities, co-developed with WHO, to improve digital health competencies and build capacity for the healthcare workforce, including efforts to scale up the use of digital tools such as informatics and telemedicine. WHO has 800 Collaborating Centres in over 80 countries worldwide, supporting its work across local contexts in diverse fields, such as biomedical ethics, nursing, occupational health, chronic diseases, and health technologies.

CENTRE FOR ASIAN NURSING STUDIES HOLDS INAUGURAL LEADERSHIP FORUM

In September 2019, TTSH’s Centre for Asian Nursing Studies (CANS) held its inaugural *Leadership Forum* for its Advisory Council members, furthering its mission to provide Asian-centred nursing thought-leadership. Members from local and overseas institutions who participated in the

“I want to see our students thrive academically. But more importantly, they must still carry the same heart for medicine they had when they first entered the doors of our medical school. We train our students to provide care rooted in compassion throughout their professional careers in medicine.”

PROFESSOR PANG WENG SUN
DEPUTY GROUP CEO (POPULATION HEALTH), NHG
& VICE DEAN (CLINICAL AFFAIRS), LEE KONG CHIAN SCHOOL OF MEDICINE

tele-conference shared best practices and discussed ideas for future care delivery and potential collaborations.

TRAINING IN INTENSIVE CARE AND NURSING PROGRAMME

In January 2020, TTSH completed its *Training in Intensive Care and Nursing (TITAN)* Programme. TITAN has successfully trained 90 doctors and nurses from Cambodia since 2017, of whom 20 were further trained in cardiac, neurological, and intensive care over a three-year period.

BELOW TTSH’s CANS held its inaugural *Leadership Forum*, furthering its mission to provide Asian-centred nursing thought-leadership.





APEC DIGITAL HUB FOR MENTAL HEALTH ROUND TABLE MEETING

IMH and the Asia-Pacific Economic Cooperation (APEC) Digital Hub for Mental Health – the coordinating centre for APEC’s work in mental health – jointly organised a round table meeting in June 2019 to renew the 2014–2020 *APEC Roadmap to Promote Mental Wellness in a Healthy Asia Pacific* to beyond 2020. The event was attended

by 34 representatives from APEC member economies such as Canada, Japan, South Korea, Vietnam, the United States, Thailand, and the Philippines, including APEC officials, and representatives from MOH and the Health Promotion Board (HPB). The discussions centred on Workplace Wellness and Resilience, Data Collection and Standardisation, and Integration with Primary Care and Community.

TOP IMH and the APEC Digital Hub for Mental Health jointly organised a roundtable meeting to renew the 2014–2020 *APEC Roadmap to Promote Mental Wellness in a Healthy Asia Pacific* to beyond 2020.

15 YEARS OF UNISA AND NHG COLLEGE COLLABORATION

2020 marks 15 years of the University of South Australia (UniSA) and NHG College’s joint collaboration in the *Master of Clinical Pharmacy programme* in Singapore. Led and taught by faculty from UniSA and hosted by NHG College in Singapore, the successful collaboration has provided opportunities for NHG pharmacists to advance their skills in specialist pharmaceutical services. To-date, the programme has completed 10 intakes, with two intakes underway. More than 70 graduate pharmacists have gone on to assume leading and specialist roles in patient care.



THIS PAGE NHG Group Education Continuing Professional Development Programme for Faculty and Programme Administrators for participants from Doha.

SECOND CONTINUING PROFESSIONAL DEVELOPMENT PROGRAMME

In November 2019, NHG Group Education conducted its second *Continuing Professional Development Programmes for Faculty and Programme Administrators* at the request of the Hamad Medical Corporation (HMC) in Qatar. Participants who attended these sessions gained insights from NHG Residency and NHG College on developments of structured trainings, best practices measurements, and developing collaborative networks.



FINANCIALS & STATISTICS



“ The fiscal prudence and discipline of successive governments have put us in a strong position to overcome this crisis, and emerge stronger after the pandemic... No one will be left behind.”

PRIME MINISTER LEE HSIEN LOONG



FINANCIALS & STATISTICS

WORKLOAD FIGURES

BED COMPLEMENTS

ACUTE HOSPITALS
Institutions: **TTSH, NCID, KTPH & IMH**

FY2019: 4,683
FY2018: 4,649

COMMUNITY HOSPITAL
Institution: **YCH**

FY2019: 224
FY2018: 258



INPATIENT DISCHARGES*

ACUTE & COMMUNITY HOSPITALS
Institutions: **TTSH, NCID, KTPH, IMH & YCH**

FY2019: 119,389
FY2018: 119,813



INPATIENT DAYS*

ACUTE & COMMUNITY HOSPITALS
Institutions: **TTSH, NCID, KTPH, IMH & YCH**

FY2019: 1,463,347
FY2018: 1,487,514



BED OCCUPANCY RATE

ACUTE & COMMUNITY HOSPITALS
Institutions: **TTSH, NCID, KTPH, IMH & YCH**

FY2019: 89%
FY2018: 90%



Note*: Year-on-year decrease in workload for inpatient, day surgeries and SOC attendances is due to the postponement of elective/non-critical surgeries and appointments to free up resources to manage COVID-19. For the polyclinics, there is also postponement of appointments in lieu of COVID-19 outbreak. However, this is more than offset by the increase in appointments from organic patient volume growth and Losartan drug recall in the months before COVID-19 outbreak.

AVERAGE LENGTH OF STAY

ACUTE HOSPITALS

Institutions: **TTSH, NCID & KTPH**

FY2019: 7.2

FY2018: 7.2

IMH – SHORT STAY

Institution: **IMH (short stay)**

FY2019: 27.2

FY2018: 29.2

IMH (long stay) for FY2019 is 558.3 days (FY2018: 603.3 days) and this relates to the average length of long-staying patients who were physically discharged during the year.

COMMUNITY HOSPITAL

Institution: **YCH**

FY2019: 25.0

FY2018: 25.9



ATTENDANCES

SOC*

Institutions: **TTSH, NCID, KTPH, IMH, NSC & AdMC**

FY2019: 1,391,248

FY2018: 1,454,593

A&E (Acute Hospitals)

Institutions: **TTSH & KTPH**

FY2019: 284,085

FY2018: 283,936

DAY REHABILITATION CENTRE (Community Hospital)

Institution: **YCH**

FY2019: 2,958

FY2018: 2,982



DAY SURGERIES*

Institutions: **TTSH, KTPH & AdMC**

FY2019: 94,805

FY2018: 100,730



ATTENDANCES

POLYCLINIC*

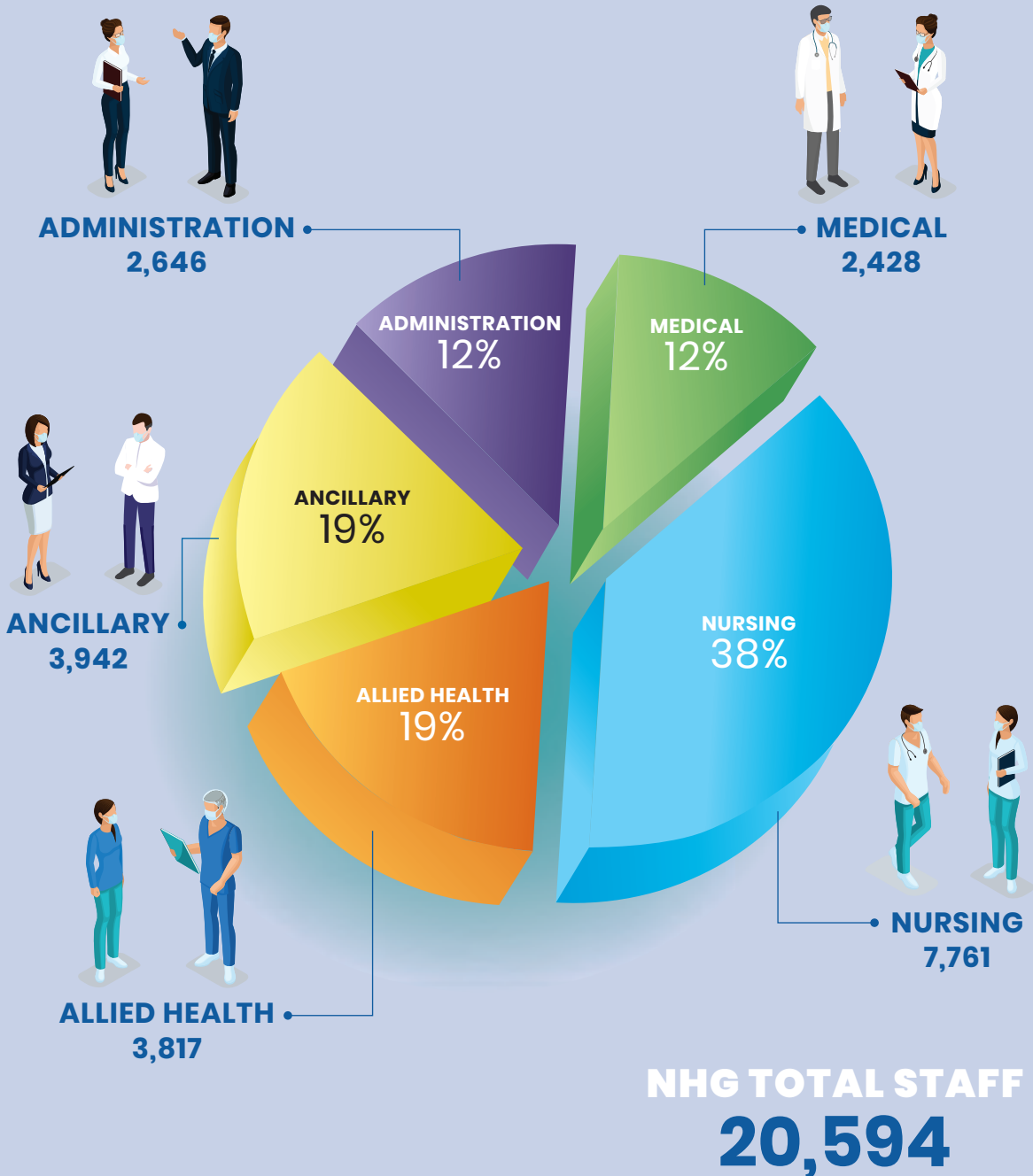
FY2019: 2,419,518

FY2018: 2,324,553



DISTRIBUTION OF STAFF

As at 31 March 2020 (FY2019)





“ We are being prudent to preserve fiscal buffers to ensure that we have the wherewithal to stand our ground and bounce back quickly if the tide turns against us. This is how we have been able to respond decisively to fight the COVID-19 outbreak, and support Singaporeans and our workers.”

DEPUTY PRIME MINISTER HENG SWEE KEAT



OUR 20-YEAR JOURNEY AS NHG: OUR PEOPLE

“ Instead of celebrating with a big birthday cake, we have stood united in our battle against COVID-19. Our collective PICS values – People-centredness, Integrity, Compassion, and Stewardship – have won us the hearts of patients and the public, and brought us through tough and good times. In a time like this, our NHG Family is staying strong and resilient.”

PROFESSOR PHILIP CHOO
GROUP CEO, NHG







NHG20: OUR PEOPLE

Our people are our most valuable resource. Over the past 20 years, NHG's organisational values have evolved to focus on People-centredness, Integrity, Compassion, and Stewardship (PICS). These collective values guide the way we conduct ourselves at work, provide care to our patients and the population, as well as interact with our stakeholders. The on-going COVID-19 has reinforced the importance of PICS, spurring us to contribute significantly to pandemic response efforts as One NHG Family. Let us continue to shine the **Torch of Hope** for our colleagues, community, and population, for future generations.



20 YEARS AS ONE NHG FAMILY

NHG LAUNCHES THE NHG20 LOGO AND CARE MASCOTS

NHG marked its 20th anniversary on 1 April 2020. The NHG20 Torch of Hope logo, designed by NHG Group Corporate Communications (GCC) to commemorate the occasion, draws inspiration from the Olympic flame and represents strength, unity, and solidarity. It symbolises our unwavering commitment to NHG’s *Adding Years of Healthy Life* vision. As part of the NHG20 celebrations, our three Care Mascots – Natty, Healthy and Groupy – were also created by GCC, with each embodying qualities such as collective leadership, people-centredness, and caring for one another. They seek to inspire hope, joy, and encouragement in staff and the community, as well as to cheer us on in fulfilling NHG’s vision, and mission, in our combat against COVID-19.



MEANING OF THE TORCH OF HOPE

INTERLOCKING ‘20’
Symbolises the camaraderie and collective leadership between NHG Institutions, patients, and partners in the community.

COLOURS
The NHG corporate teal colour applied on the ‘20’ reflects its dedication to deliver consistent quality care. The flames’ vibrant hues are made up of the colours of NHG and its Institutions.



STYLISTED FLAME
Encapsulates NHG’s passion and increasing commitment to its vision, mission, and values.

FOUR INTERWEAVED FIGURES
Represent different colours of our Institutions, stakeholders, healthcare professionals, patients, caregivers, and community partners. Together, they form the heart of NHG.

TAGLINE

- Expands on NHG’s vision of *Adding Years of Healthy Life*.
- “Spark” conveys its passion and zeal to care for the nation and its patients, with people-centredness, integrity, compassion, and stewardship (PICS).
- “Radiate” demonstrates the *kampung* spirit and showcases the meaningful relationships with colleagues, partners, and our community.

THE TORCH OF HOPE MUSIC VIDEO DEDICATED TO OUR HEALTHCARE FAMILY

To commemorate NHG20 and thank all frontliners in Singapore for their work in COVID-19, a heart-warming song “Torch of Hope” was co-produced by NHG GCC and Singapore veteran singer, Clement Chow. The song, which is based on NHG’s vision of *Adding Years of Healthy Life*, fosters camaraderie among the NHG Family, and encourages patients and the public to stay strong and united in overcoming the pandemic. Senior Management and staff across Institutions participated as part of a “virtual choir” to galvanise all healthcare workers in our fight on the frontlines.

Scan the QR code to watch the Torch of Hope music videos.



NHG20 JACKET

To mark our 20th year milestone, as well as to thank our people for their hard work, NHG produced a special NHG20 Jacket – one that every staff will be proud to wear.



THIS PAGE Staff across NHG Institutions rallied together to sing the Torch of Hope to galvanise frontline workers, fellow colleagues, and the public.



WE GIVE THANKS

NHG board members share their well-wishes and gratitude to celebrate NHG20.

“When NHG was set up, it was the smaller of two clusters. We turned this smallness into an advantage, as it allowed us to act nimbly and boldly. We also leveraged strongly on our people. It was the dedication and hard work which saw us through SARS and which put us in a good position against COVID-19. Thank you, everyone for your excellent work and commitment.”

MRTAN TEE HOW
DEPUTY CHAIRMAN

“I appreciate the tireless efforts put in by staff and management to fight the pandemic. The opening of NCID – with its dedicated, highly-trained staff and well-equipped facilities – has proven timely.”

MRS YEE JEE HONG

“To the fantastic team in NHG for bravely soldiering on, despite the emotional toil and physical exhaustion. Our thoughts and best wishes to all.”

MR GABRIEL LIM

“Thank you for the fantastic work that all of you are doing to keep us safe.”

MR GIRIJA PANDE

“Thank you to all the pioneers who led and built our first-class healthcare institutions. NHG was the mover. Our passionate healthcare staff, doctors, nurses, and leaders make all the difference in caring for our population.”

PROFESSOR ER LAU JOO MING

“I am proud to be part of the wonderful family that makes up our NHG Cluster. The hard work and caring dedication from everyone is going to see us through this far more challenging crisis than SARS. My deepest thanks and thoughts are with you constantly as you battle this pandemic with bravery and resilience.”

MADAM KAY KUOK
CHAIRMAN

“We recognise the huge personal sacrifices you are all making, and also that of your families. I pray that this will be over soon.”

MS CHU SWEE YEOK

“My heartfelt thanks to all involved in caring for those affected by COVID-19. Superb organisation, teamwork, and leadership are evident in this tremendous effort. At Lee Kong Chian School of Medicine (LKCMedicine), we are proud that some of our medical graduates are contributing to this work.”

PROFESSOR JAMES BEST

“Words cannot fully describe my admiration and appreciation for the sacrifices and professionalism of the management and staff in dealing with the COVID-19 pandemic.”

MR RAMLEE BIN BUANG

“My best wishes and appreciation for our healthcare workers in these difficult times.”

MRTOW HENG TAN

“I am deeply grateful and moved by the work that you do at NHG. This crisis exemplifies how much we have to be thankful for. Stay safe.”

MS LOCK YIN MEI

“Many thanks to all in NHG for your selfless, fearless, and professional service. Take care, stay safe, strong, and healthy.”

MR ROBERT CHEW
(Former Board Member)



DEVELOPING OUR PEOPLE

NHG believes in developing our people to be a future-ready healthcare workforce. We are committed to building the competencies and capabilities of our people through training, talent retention, upskilling, and equipping them to provide better care for our population.

THE NATIONAL SKILLS FRAMEWORK ADOPTION

The national Skills Framework for Healthcare was launched in March 2019 with the objective of building a future-ready healthcare workforce. Since then, professional leads from various family groups and Human Resource (HR) teams across NHG Institutions have been engaged in adopting the framework to strengthen HR practices, including redesigning jobs, recruiting new entrants, rejuvenating skill sets, and staff retention. In terms of Learning and Development, core and generic



skills across professions were identified to help enhance the relevance of the training curriculum. NHG also referenced the framework to review, align, and calibrate existing job descriptions, and benchmarked with industry standards to optimise performance management and recruitment.

NHG INTRODUCES MANAGER'S CAPABILITY DEVELOPMENT FRAMEWORK

In line with NHG's HR Transformation, the Group HR Development (GHRD) team launched a Manager's Capability Development (MCD) Framework in January 2020. The MCD provides a structured approach to develop NHG's managers in people-building capabilities. A six-month pilot is scheduled to take place between August 2020 and January 2021.





REFLECTIONS

“As NHG turns 20, it also marks my 20th year of service. As at NHG and TTSH, I have grown up among the best healthcare leaders and friends. I am thankful for the opportunities to serve and build the future of healthcare together.”

PROFESSOR EUGENE FIDELIS SOH
CEO, TAN TOCK SENG HOSPITAL & CENTRAL HEALTH

“I have witnessed NHGP enthusiastically forging ahead the advancement of Family Medicine and transforming primary healthcare through research, innovation, and technology to gain greater outreach with our patients and impact the population we serve. Our best practices and improved patient care have shaped the teaching of primary care, and nurtured doctors in the three medical schools in Singapore.”

ASSOCIATE PROFESSOR CHONG PHUI-NAH
CEO, NATIONAL HEALTHCARE GROUP POLYCLINICS & PRIMARY CARE

“Since NHG was first established in the year 2000, what sustained us over the years were our values. The can-do spirit and the public ethos of wanting to do good for the nation, have stood the test of time. In addition, the spirit of collaboration across different settings and professions has also remained unchanged, and has helped us through periods of crisis and challenging times. The fact that our people in NHG are highly professional, competent and have a sense of being part of a greater purpose and mission, has played a significant role in our achievements for the past twenty years.”

DR JASON CHEAH
DEPUTY GROUP CEO (TRANSFORMATION), NHG & CEO, WOODLANDS HEALTH CAMPUS

“It has been a rewarding journey for me as a clinician and a leader to have worked with other passionate leaders. I look forward to helping IMH fulfil its mission of providing mental healthcare for Singapore.”

PROFESSOR CHUA HONG CHOON
DEPUTY GROUP CEO (CLINICAL), NHG & CEO, INSTITUTE OF MENTAL HEALTH

“What keeps me going in my 20-plus years at NHG are the people whom I have been with on this journey – our patients, our leadership, and colleagues, and my family.

The COVID-19 crisis has been a period of reimagining what NSC could do to make a difference even though we are not in the frontline operations. Doctors, nurses, allied health professionals, and administration staff volunteered and rallied together to help in the national effort – it was inspiring and heartwarming.”

PROFESSOR TAN SUAT HOON
DIRECTOR, NATIONAL SKIN CENTRE

“There is great scope for research, with NHG encompassing three general hospitals, national centres for infectious diseases, mental health, geriatrics, and skin diseases. A sensible mix of innovation and technology, with a close eye on cost effectiveness is where I hope to make a difference, with my background in public health.”

DR BENJAMIN SEET
DEPUTY GROUP CEO (EDUCATION AND RESEARCH), NHG

“I recall the formation of NHG in March 2000. Alexandra Hospital, where I was COO then, joined as one of its member Institutions later that year. Our common vision of Adding Years of Healthy Life to the people of Singapore has kept us focused on improving, innovating, and learning together. NHG has come a long way since then, and I am proud to be part of this health system that is moving beyond episodic care, to leading healthcare professionals in improving health and reducing illness in the River of Life.”

MRS CHEW KWEE TIANG
CEO, KHOO TECK PUAT HOSPITAL & YISHUN HEALTH

“I was in TTSH when NHG was set up in 2000. Over the years, NHG has built a strong leadership team across its Institutions. This stood out in COVID-19 when I saw the different teams coming together as one across the ranks. It reminded me once again of the good old spirit – which is committed, and dedicated in serving the community.”

PROFESSOR PANG WENG SUN
DEPUTY GROUP CEO (POPULATION HEALTH), NHG





TTSH AND HEALTHCARE ACADEMY COLLABORATE TO DEVELOP HEALTHCARE WORKERS

The Company Training Committee (CTC) comprising the Centre for Healthcare Innovation (CHI), the Healthcare Academy's (HCA) Healthcare Services Employees' Union, NTUC's e2i, and NTUC LearningHub, was formalised through a Memorandum of Understanding signed in May 2019. The CTC enables organisations to identify skill gaps for healthcare professionals and co-develop training programmes. Participants are enabled to

adapt to disruptions in the workplace environment, as well as be actively involved in workforce transformation, and remain employable.

YISHUN HEALTH IS COMMITTED TO BUILDING A FUTURE-READY WORKFORCE

Yishun Health awarded close to 100 in-service sponsorships and scholarships to staff in FY2019. Its educational initiatives including local and international programmes, and clinical attachments have enabled staff to upgrade their competencies and prepare for the future.



REFLECTIONS

“I have spent almost my entire professional life working in NHG hospitals. I always pride myself on being a member of an organisation that genuinely cares for its patients, staff, and communities. Almost 30 years on, I am glad to be able to continue to contribute to this legacy.”

ASSOCIATE PROFESSOR PEK WEE YANG
CHAIRMAN MEDICAL BOARD,
KHOO TECK PUAT HOSPITAL
& YISHUN HEALTH

“NHG, from the start, has embraced the fact that we distinguish ourselves through Quality and Safety. I am grateful for the opportunity for the last 20 years to be nurtured and to be able to contribute to our Quality movement in NHG, to provide our patients with better and safer care.”

ASSOCIATE PROFESSOR TAI HWEI YEE
GROUP CHIEF QUALITY OFFICER, NHG

“My journey with the NHG Family has been exciting and meaningful. I am thankful that I am able to play my part to ensure NHG and its Institutions have the critical IT infrastructure needed to function smoothly during this global COVID-19 crisis, so that we can focus on what matters most – our patients.”

MR HUAN BOON KEAN
GROUP CHIEF INFORMATION OFFICER, NHG

“NHG has played a steady and unwavering role during the COVID-19 pandemic – keeping an eye on the big picture, being equal to the task, willing to get our feet wet no matter how messy the situation, with practical, timely efforts, while maintaining a collective, calm resolve to get the job done.”

DR ELAINE TAN
DEPUTY CHIEF OPERATING OFFICER
(POPULATION HEALTH), NHG

“The COVID-19 pandemic has evoked a strong sense of purpose and determination in all of us. It has altered boundaries and accelerated the change in our perception of what and how things can be done. There is no going back to life before COVID-19. The resilience and tenacity that the team has demonstrated gives me great confidence that we will continue to break new ground!”

MS CHAN SOO CHUNG
EXECUTIVE DIRECTOR,
NHG PHARMACY

“COVID-19 has turned out to be the global crisis of this generation and despite the challenges, NHG has kept up its cybersecurity vigilance. Cybersecurity is team effort. At the end of the day, our goal is to ensure the safety of our patients.”

MR LIM THOW CHANG
GROUP CHIEF INFORMATION SECURITY OFFICER, NHG

“Over the last 20 years, NHG has given me multiple opportunities to learn and grow. It has provided the environment for my teachers to become mentors, my colleagues to become friends, and my friends to become family.”

ASSOCIATE PROFESSOR NICHOLAS CHEW
GROUP CHIEF EDUCATION OFFICER,
NHG & CHAIRMAN MEDICAL BOARD, WOODLANDS HEALTH CAMPUS

“Agility in leadership, delivery of services, tech-enabled operating models, talent management, staff motivation, innovative processes, radical ways of thinking, business continuity plans, and risk exigencies, will be embedded in our ‘new normal’ and ‘new DNA’.”

MS WONG FONG TZE
GROUP CHIEF CORPORATE COMMUNICATIONS OFFICER, NHG



ENGAGING OUR PEOPLE

We engage and motivate our people through meaningful platforms, building a workplace where people find value and feel valued, with relationships at the heart of it all.

MOH-NHG ENGAGEMENT EVENTS

In 2019, NHG and the Ministry of Health (MOH) co-organised sessions to celebrate Ramadan Iftar, and Deepavali with our Muslim, and Hindu colleagues. A dinner was held at Tan Tock Seng Hospital (TTSH) in May to observed Ramadan, while Khoo Teck Puat Hospital (KTPH) hosted a Deepavali event in October.



MOH-NHG TOWNHALL

In August 2019, the MOH-NHG Townhall was held at the Ng Teng Fong Centre for Healthcare Innovation (CHI) Auditorium. Attended by more than 500 NHG management, staff, and community partners, the Townhall was a forum to discuss some key issues on public healthcare. Minister for Health, Mr Gan Kim Yong reiterated the importance of staying vigilant amid emerging cybersecurity risks and privacy concerns; driving Care Transformation through a broad Population Health approach, and accelerating Business Transformation by tapping on digital and data tools. The panel also comprised Dr Lam Pin Min, former Senior Minister of State for Health and Transport; and Professor Philip Choo, Group CEO, NHG. The Townhall was moderated by Professor Chua Hong Choon, Deputy Group CEO (Clinical), NHG and CEO, Institute of Mental Health (IMH).

NHG STRATEGIC COMMUNICATIONS SUMMIT 2019

The NHG Strategic Communications Summit 2019 held in November 2019 was attended by 40 staff from across different departments and Institutions of the NHG Family. Themed “Landscape for Communication – Now & Into the Future”, participants discussed pertinent issues and developments in NHG and public healthcare. In addition, fun challenges and team-bonding activities fostered the WE are ONE Team and ONE NHG identity that helped develop camaraderie among participants. The Summit was organised and facilitated by Ms Wong Fong Tze, GCCCO, with the Group Corporate Communications (GCC) Team.





Experts invited included: Ms Yen Tan, Chief Operating Officer, KTPH and Yishun Health; Ms Chan Soo Chung, Executive Director, NHG Pharmacy (NHGPh); Associate Professor Daniel Fung, Chairman Medical Board, IMH; Dr Wei Ker-Chiah, Senior Consultant and Chief of the West Region, IMH; Associate Professor Tan Cher Heng, Senior Consultant, TTSH and Co-Director, Centre for Medical Technologies and Innovations (CMTi), NHG; Dr Adeline Lam, Consultant, TTSH; Ms Tracy Gan, Deputy Director, Service Leadership and Patient Relations (SLPR), NHGP and Dr Howard Foo, Chief Human Resource Officer, WHC. Topics presented by the experts included managing stress in work and life, Advance Care Planning (ACP), building a culture of sustainability at KTPH, and updates on WHC.





NHG HQ CHARITY CARNIVAL 2020

The NHG HQ Charity Carnival is an annual fund-raising event organised by HQ staff to bond and to give back to the community. Held in January 2020, HQ departments and Business Units set up booths to sell a variety of handmade items. The funds raised were donated to two charities nominated by staff: Good Shepherd Centre and Movement for the Intellectually Disabled of Singapore (Yishun Training & Development Centre).



LEFT & ABOVE RIGHT HQ departments and Business Units set up booths at the NHG HQ Charity Carnival.

“ While we wait for a vaccine, masks and safe distancing would have to be part of everyday life. I am realistic that how we operate henceforth, whether at work, at play, or at home, would need a rewiring of mindset, behaviour, and sustained actions. The world as we knew of pre-COVID-19 has changed forever. But one value remains constant – compassion. We give thanks to all who have contributed to make our lives a little better. We shall overcome, together. *”

MS WONG FONG TZE
GROUP CHIEF CORPORATE COMMUNICATIONS OFFICER, NHG



* Read how we survived through Singapore's Circuit Breaker 2020, in NHG's issue of Lifewise (Oct-Dec), *Our Circuit Breaker Journal* (through the lens of NHG Group Corporate Communications) www.corp.nhg.com.sg



STAYING WELL

NHG aims to build and foster a culture of health ownership through Education, Empowerment, and Engagement. Through the Zest for Life framework, NHG empowers our staff to adopt a healthy mind and physical well-being, holistically. A healthy NHG workforce translates to better care for the community.



NHG RECOGNISED AT THE SINGAPORE HEALTH AWARD 2019

In October 2019, NHG and Institutions were recognised for their efforts in promoting workplace health at the Singapore HEALTH Award (SHA) 2019, a symposium organised by the Health Promotion Board (HPB) to facilitate learning, sharing of best practices, and knowledge exchange on health promotion.

FIT YOUR LIFE

In June 2019, NHG HQ launched Fit Your Life (FYL), a lifestyle management programme that encouraged participants to focus on holistic wellness instead of BMI-related issues. FYL was conceptualised through the efforts of internal and external clinicians, and nutritionists. NHG also partnered Republic Polytechnic students, leveraging on their Sports Science knowledge to enrich the curriculum. Staff who registered for FYL are educated on fitness, nutrition, and psychological health.

LAUNCH OF PEER SUPPORT PROGRAMME

The Peer Support Programme was introduced in October 2019 to build a resilient workforce. It is a platform for NHG HQ staff to support each other, and improve psychological well-being in the workplace. To-date, there are 34 peer supporters who have been trained on common mental health issues faced by Singaporeans. They are equipped by accredited organisations to provide relevant support to their peers.

SINGAPORE LEADERS PLEDGE TO CHAMPION EMPLOYEES' MENTAL WELL-BEING

In October 2019, 20 leaders from the private and public sectors signed a joint pledge to champion mental well-being within their organisations and the wider Singapore workforce. The pledge was part of a closed-door dialogue session on workplace well-being, organised by the WorkWell Leaders Workgroup (WLW). The leaders discussed strategic insights and shared best practices on employee mental health. Professor Chua Hong Choon, Deputy Group Chief Executive Officer (Clinical), NHG, and CEO, IMH, participated in the dialogue. Prof Chua helms the Joy In Work Workgroup in NHG.



REFLECTIONS

“The main catalyst for innovation should be a desire to improve and do one’s work better. From the ground up, staff need to develop a culture of wanting to do things better, and from the top, there needs to be reassurance that this is a proven method of doing things better and to change the practice. Ultimately, the focus needs to be on the patient.”

ASSOCIATE PROFESSOR CHIN JING JIH
CHAIRMAN MEDICAL BOARD,
TAN TOCK SENG HOSPITAL &
CENTRAL HEALTH

“20/20 suggests that we have a clear vision for our mission and it is more than just saving the drowning from the *River of Life* but asking why people are falling in, in the first place.”

ASSOCIATE PROFESSOR DANIEL FUNG
CHAIRMAN MEDICAL BOARD,
INSTITUTE OF MENTAL HEALTH

“At the height of our battle against COVID-19, all hands were on deck. When TTSH Nursing made a call for nursing resources to support TTSH-NCID, I was thrilled when help from NHG Institutions came readily and fast! I observed the same camaraderie again when WHC sought assistance for the CCF at Singapore Expo. We collectively steward NHG through the *River of Life*.”

MR YONG KENG KWANG
GROUP CHIEF NURSE, NHG

“When you join NHG, you are part of a big family. Though I had no prior experience in healthcare, everyone welcomed me warmly. Every day brings fresh experiences and hope, as we transform healthcare and care delivery. We have moved beyond hospital walls to the *River of Life* in serving our population.”

MR LIM HOCK LENG
CHIEF OPERATING OFFICER,
INSTITUTE OF MENTAL HEALTH

“Aspiring to practise good Family Medicine, I started my journey with NHG in Toa Payoh Polyclinic as a trainee and have never looked back. I am grateful for my mentors and inspired by the friendships forged.”

DR KAREN NG
DIRECTOR, CLINICAL SERVICES,
NATIONAL HEALTHCARE
GROUP POLYCLINICS

“Healthcare will transform itself fundamentally through the NGEMR. NHG is enthused on this vision to bridge the gap between consultations, provide greater care, and ensure a healthier population.”

ASSISTANT PROFESSOR ERIC WONG
GROUP CHIEF CLINICAL
INFORMATICS OFFICER, NHG

“When NHG was inaugurated in 2000, I was just a freshman in healthcare. I remember helping to organise NHG’s first Quality Day in Alexandra Hospital and participating in Learning Programmes over the years. Many friendships were formed and gave us the foundation to collaborate.”

MS YEN TAN
CHIEF OPERATING OFFICER,
KHOO TECK PUAT HOSPITAL
& YISHUN HEALTH

“At NHG, we see every challenge as an opportunity to strengthen teamwork and forge camaraderie.”

MR DARION CHONG
GROUP CHIEF CORPORATE
DEVELOPMENT OFFICER
& GROUP CHIEF DATA
PROTECTION OFFICER, NHG

“C S Lewis once wrote that, ‘The rescue of drowning men is, then, a duty worth dying for, but not worth living for.’ While duty calls and demands that we do our best, we must not let the crisis totally consume us, and what we ultimately live for. The quote exemplifies how we in NHG are not just healthcare workers but brothers, sisters, children, parents, students, teachers, or friends in the broader community. These other roles are equally important and our duty too. If we can find the balance in the work we do with our life in the community, we would realise that what we do in NHG is of relevance to the lives of its employees, and the population we serve, and that realisation would give a greater meaning to our existence.”

ASSOCIATE PROFESSOR THOMAS LEW
GROUP CHIEF DATA AND
STRATEGY OFFICER, NHG



RECOGNISING OUR STAFF AND PARTNERS

NHG QUALITY DAY 2019

NHG held its annual Quality Day at KTPH with the theme of “System Reliability”. Some 124 Quality Improvement projects were submitted with 21 teams awarded prizes. They included the NHG Excellence in Action Awards (EIAA), and NHG Exemplary Patient and Caregiver (EPCA) Awards. Participants were geared higher on system reliability through learning more on designing system level processes and challenges, and risk management in healthcare.



NHG TEACHERS’ DAY AWARDS

NHG held its NHG Teachers’ Day in September 2019 at the Tan Tock Seng Hospital (TTSH) Atrium. NHG honoured 190 healthcare educators from various disciplines – medical, nursing, allied health, and pharmacy. The winners were nominated across 12 award categories for their dedication and commitment towards the growth and professional development of their fellow colleagues and students. Ten awards were presented to educators from WHC in recognition of their continued teaching efforts as they lay the groundwork for the opening of the premises in 2023.



NURSES’ MERIT AWARDS 2019

Minister for Health Mr Gan Kim Yong officiated at the Nurses’ Merit Award 2019 in July 2019. 101 nurses were accorded recognition for their remarkable performance and commitment to the profession. The recipients were from the community care sector, private hospitals, and public healthcare institutions. They included nurses from TTSH, KTPH, Yishun Community Hospital (YCH), IMH, WHC, NHGP, and NSC.

TTSH RECOGNISED FOR EXCELLENCE IN LEADERSHIP AND MANAGEMENT

In November 2019, the TTSH Frequent Readmitter Programme won the 2019 International Hospital Federation (IHF) Excellence Award for Leadership and Management in Healthcare (Merit). The IHF Awards recognised hospitals and healthcare organisations for innovation, excellence, outstanding achievements, and best practices. The Frequent Readmitter Programme was highlighted for its effective and robust processes in proactively identifying and managing patients with a pre-determined number of readmission episodes within a year. Its person-centred, multi-disciplinary approach facilitated holistic management of patient care from hospital to home.



WHC DEPUTY DIRECTOR OF NURSING LAUDED WITH PRESIDENT’S AWARD FOR NURSES

Ms Kala D/O Narayanasamy, Deputy Director of Nursing, WHC, was one of five nurses presented with the President’s Award for Nurses in July 2020, the highest accolade for Singapore’s nursing profession. The award honours nurses who have shown sustained outstanding performance and contributions to patient care delivery, education, research, and administration. Ms Kala has been in nursing since 1982. During the coronavirus pandemic, she tapped on her experience during the SARS crisis to introduce workflows and standard operating procedures to convert wards at Yishun Community Hospital (YCH) to care for COVID-19 patients. She is involved in the planning operations of WHC and is a well-respected leader among her colleagues.



NANYANG EDUCATION AWARD 2019

Associate Professor Lim Poh Lian, Director of the High Level Isolation Unit, National Centre for Infectious Diseases (NCID), Head of Travellers' Health & Vaccination Clinic, TTSH, and Associate Professor at the Lee Kong Chian School of Medicine, was presented the Nanyang Education Award (School) at the annual Nanyang Technological University Awards in September 2019. The Nanyang Education Award is the highest honour conferred to faculty members for teaching. A/Prof Lim was recognised for her dedication and achievements in teaching and mentorship, and for inspiring and enriching students in their learning experience.

NHG CLINICIANS HONOURED AT NUS YONG LOO LIN SCHOOL OF MEDICINE DEAN'S APPRECIATION AWARDS

In November 2019, 63 awards were presented to NHG clinicians and clinical departments at the National University of Singapore (NUS) Dean's Appreciation Awards. The TTSH Department of Psychological Medicine and the KTPH Department of Anaesthesia received the Clinical Excellence Training Award (Department), which recognised clinical departments that have achieved excellent posting scores and teaching scores for two consecutive years.

NHG RESIDENCY MVP AWARD

NHG residents - junior doctors training to be specialists - stepped up to volunteer at the COVID-19 frontline, on top of their clinical commitments. The Most Valuable Player (MVP) award, given out by NHG Group Education, acknowledged NHG residents who have gone beyond the call of duty for their patients and their peers. Winners were nominated by their colleagues, peers, and senior doctors.



NHGD SENIOR MEDICAL TECHNOLOGIST RECEIVES PUBLIC SECTOR TRANSFORMATION AWARD

In July 2019, NHGD senior medical technologist Ms Anna Tang was presented the 'Dare To Do' Award at the Public Sector Transformation Awards for her efforts in bringing NHGD's Phlebotomy Services from the polyclinics to homes to better serve patients. The 'Dare to Do' Award recognises the spirit of risk-taking, innovation and perseverance in the public sector.



PRESIDENT OF THE COLLEGE OF CLINICIAN EDUCATORS

Associate Professor Yip Chee Chew, Education Director, and Head and Senior Consultant, Ophthalmology and Visual Sciences (OVS) Department, KTPH, was elected President of the College of Clinician Educators (CCE) Singapore in November 2019. Established in 2017, CCE is a non-independent college under the Academy of Medicine (Singapore) that focuses on the development of purposeful and synergistic initiatives in clinical medical education. It also serves an advisory role in nurturing a culture of educational scholarship and innovation.

IMH PSYCHOLOGIST APPOINTED PANEL ADVISOR TO YOUTH COURT

Dr Ong Lue Ping, Head and Principal Clinical Psychologist, Department of Psychology, IMH, was appointed Panel Advisor to the Youth Court by President Halimah Yacob in January 2020. The Youth Court typically deals with cases where youths are beyond parental control and have committed offences, and also cases involving the protection of children. As Panel Advisor, Dr Ong advises the Court Judge on the appropriate orders to pass for children or youth. The panel comprises individuals from diverse fields, such as social services, medicine, finance, and legal.

TOGETHER WITH THE COMMUNITY



YEAR-END THANK YOU CONCERT

NHG Senior Management, community friends, and GCC came together to bring festive cheer to healthcare staff, patients, and caregivers during the annual year-end NHG Thank You Concert at the TTSH Atrium in December 2019. The audience enjoyed music performances, balloon sculpting, magic show, and ‘Arts and Craft’. They sang along and moved to a medley of local favourites and Christmas carols. The Concert expressed NHG’s gratitude to staff, patients, their families and caregivers, and volunteers for collective partnership in care. Performers represented the diverse population NHG serves. They included, the Rave Harps’ graceful senior harpists; National Day Parade (NDP) 2019 singers, 12-year-old Jordin Tan and veteran musician Clement Chow; Helga Udovchenko, a Ukrainian married to a Singaporean, who sang in English and Chinese; and Jazz artiste Michelle Poh, daughter of TTSH pioneer volunteer Michael Poh. The audience also enjoyed the finale item with well wishes sung by Group CEO Professor Philip Choo and Team NHG with our partners. Apples, biscuits, health booklets and the newly minted NHG Calendar 2020 distributed were all well-received.



ABOVE Arts and Crafts booth at the year-end NHG Thank You Concert.



NHG CORPORATE SOCIAL RESPONSIBILITY ENGAGEMENT

Corporate Social Responsibility (CSR) is an avenue for staff to show care and compassion to the community. Activities in 2019 included a supermarket shopping and tea session with the elderly from TOUCH Community Services, and a BBQ session with residents from Society for the Aged Sick (SAS). In addition, seniors from the Care Community Services Society Singapore (CCSS) were brought on an interactive, behind-the-scenes tour of media and broadcasting at The Mediacorp Experience.





REFLECTIONS

“NHG has turned 20 years old and for the past two decades, we have built a comprehensive service within the cluster as well as established collaborations within the nation. The emphasis on our ability to combat emerging infections and to reach out to the community has served us greatly, especially in supporting NCID and Singapore to confront and combat the COVID-19 pandemic.”

PROFESSOR LEOYEE SIN
EXECUTIVE DIRECTOR,
NATIONAL CENTRE FOR
INFECTIOUS DISEASES

“My journey with NHG has been enriched with opportunities to work with Institutions across NHG, and the public and private sectors to transform healthcare delivery in Singapore. I have been fortunate to have met leaders who believe in nurturing and developing people, and in building trust and relationships.”

MS LIM SOH HAR
EXECUTIVE DIRECTOR,
NHG DIAGNOSTICS

“To attain knowledge, add things every day. To attain wisdom, remove things every day – Lao Tzu.”

DR HENG BEE HOON
SENIOR DIRECTOR, HEALTH
SERVICES & OUTCOMES
RESEARCH, NHG

“As NHG and TTSH continue to expand, we need to steadfastly preserve our core values to keep human relationships grounded and personal. In our battle with COVID-19, I am heartened to see how staff rallied together, volunteered and went beyond their call of duty to fight the outbreak.”

DR JAMIE MERVYN LIM
CHIEF OPERATING OFFICER,
TAN TOCK SENG HOSPITAL
& CENTRAL HEALTH

“Everyone has a voice, and everyone’s voice is heard.”

DR SIMON LEE
CHIEF OPERATING OFFICER &
CHIEF CLINICAL INFORMATICS
OFFICER, NATIONAL
HEALTHCARE
GROUP POLYCLINICS

“NHG’s collective work on population health actively intervenes at the key life stages of a person’s *River Of Life* journey. This goes beyond illness and community-based senior/frailty care delivery – which remains core to our population health focus – into the wellness and preventative spectrum of people’s lives.”

DR WONG KIRK CHUAN
CHIEF OPERATING OFFICER
(POPULATION HEALTH), NHG
& CHIEF OPERATING OFFICER,
WOODLANDS HEALTH CAMPUS

“My 24 years in the fast-evolving vibrant healthcare sector have been very rewarding. We continue to deliver value to our clients and partners. During this COVID-19 crisis, we have seen our people at their best.”

MS LIM YEE JUAN
GROUP CHIEF FINANCIAL
OFFICER, NHG

“It has been 19 years since I joined NHG. It is a journey I have not regretted and am still motivated to press on! NHG’s vision of Adding Years of Healthy Life has remained relevant throughout the years as healthcare evolved from service efficiency to quality outcomes to population health management. I enjoy meaningful conversations with leadership and colleagues, who never fail to inspire me with their steadfastness in the pursuit for a better system to meet the changing needs of our population.”

MRS OLIVIA TAY
GROUP CHIEF HUMAN RESOURCE
OFFICER, NHG





ABOVE NHG Senior Management and Member of Parliament Denise Phua Lay Peng, who was the Guest-of-Honour at the Singapore Patient Conference (SPC) 2019.

SINGAPORE PATIENT CONFERENCE 2019

The Singapore Patient Conference (SPC) 2019 was held last October at the Ng Teng Fong Centre for Healthcare Innovation (CHI). Patients, caregivers, volunteers, community partners, and health and social care professionals gathered to share their stories and spark new ideas to build a community of carers. In conjunction with the event, nine individuals and eight groups were honoured with the Singapore Patient Action Awards (SPAA), for making a positive difference to the community through compassion, empathy, resilience, and generosity of spirit. The NHGP Guiding Hands Volunteer Programme won the Singapore Patient Support/Volunteer Group Award for helping those in need and improving care delivery and services. The team helping The HUT at IMH received the Singapore Patient Engagement Initiative (Team Award).

MENTAL HEALTH CARNIVAL 2019

In October 2019, IMH held the Mental Health Carnival to raise awareness of mental illness, the Carnival was attended by some 1,000 visitors. They learnt about IMH’s therapeutic and rehabilitative programmes, and participated in a bazaar organised by community partners and Social Service Organisations.



ABOVE NSC visited St Andrew’s Nursing Home (SAHN) and organised an art jamming session with the residents.

NSC VISITED THE ST ANDREW’S NURSING HOME

In November 2019, NSC visited St Andrew’s Nursing Home (SANH) and organised an art jamming session with the residents. The NSC Nursing department also partnered SANH to provide wound care training to its staff.



FIRST TIME, UNITED IN UNIFORM ACROSS NHG

On 19 October 2020, NHG launched a new set of uniforms for our Nursing Officers, Registered Nurses and Enrolled Nurses. As part of the annual cycle to provide a fresh set of uniforms due to wear and tear, we have taken the opportunity to refresh the uniforms' design. Based on NHG's "Better People, Better Care" principle, we have improved the functionality and flexibility of the uniforms. Worn across all NHG Institutions, the new uniforms present a united look and feel for our nurses.

Thank you NHG Chairman, Group CEO, CEOs of Institutions, NHG Uniforms Review Committee, Group Chief Nurse, Group CFO and Group CHRO & Finance, HR, Nursing, MMD and Linens Departments for your valuable advice. We also thank more than 5,000 staff who had joined and advised us on the journey as models, focus group participants, on-site testers, roadshow attendees and co-creation partners.



AWARDS & ACCOLADES FY2019


INTERNATIONAL AWARDS	
APEX 2020	8
ASIAN ELDERLY CARE AWARDS 2019	6
ASIAN HOSPITAL MANAGEMENT AWARDS 2019	5
ASIA PACIFIC HIMSS-ELSEVIER DIGITAL HEALTHCARE AWARD	1
ASSOCIATION FOR TALENT DEVELOPMENT BEST AWARD	1
INTERNATIONAL HOSPITAL FEDERATION AWARD 2019	1
○ IHF Excellence Award for Leadership and Management in Healthcare (Merit Award)	1
19TH CCAS* INTERNATIONAL CONTACT CENTRE AWARDS	2
SEOUL DESIGN FOUNDATION HUMAN CITY DESIGN AWARD 2019	1

NATIONAL AWARDS	
COMMUNITY CHEST AWARDS - CHARITY GOLD	1
ENABLING EMPLOYERS AWARD - CERTIFICATE OF RECOGNITION	1
HEALTHCARE HUMANITY AWARDS 2019	11
MAY DAY AWARDS 2019	2
MOH APPRECIATION AND AWARDS 2019	18
NATIONAL DAY AWARDS	166
NATIONAL HEALTHCARE INNOVATION & PRODUCTIVITY MEDAL	5
NATIONAL MEDICAL RESEARCH COUNCIL AWARDS	20
NATIONAL MEDICAL EXCELLENCE AWARDS	1
NURSES MERIT AWARD	27
PRESIDENT'S AWARD FOR NURSES 2019	1
PUBLIC SECTOR TRANSFORMATION AWARD	8
SHBC 2019 SCIENTIFIC COMPETITION AWARDS	42
SINGAPORE HEALTH AWARD	6
TAN CHIN TUAN NURSING AWARD	2
TOTAL DEFENCE AWARDS: NS ADVOCATE AWARDS (GOLD)	1

TERTIARY EDUCATION INSTITUTION AWARDS	
NHG-LEE KONG CHIAN SCHOOL OF MEDICINE	10
○ Koh Boon Hwee Scholars Award	1
○ Nanyang Education Award (School)	1
○ NHG-LKCMedicine Clinician Scientist Fellowship 2019	8
NATIONAL UNIVERSITY OF SINGAPORE	1
○ Ann Wee NUS Social Work Alumni Award	1
NUS YONG LOO LIN SCHOOL OF MEDICINE	57

NHG AWARDS	
NHG DEVELOPMENT AWARDS 2019	72
○ HMDP [^] (Leadership)	2
○ HMDP (Team-Based)	17
○ HMDP (Medical)	40
○ HMDP (Admin - Executive Development Programme (EDP))	4
○ HMDP (Allied Health Professionals)	5
○ HMDP (Nursing)	2
○ NHG Management Scholarship (NMS)	1
○ Postgraduate Self Development Programme (PSDA)	1
NHG RECOGNITION AWARDS 2019	47
○ Lifetime Achievement (LA)	1
○ Distinguished Senior Clinician Award (DSCA)	3
○ Distinguished Achievement (DA)	4
○ Outstanding Citizenship (OC)	10
○ Young Achiever (YA)	16
○ Team Recognition Award (TRA)	13
NHG TEACHING EXCELLENCE AWARDS 2019	190
○ NHG Education Leaders Award	7
○ NHG Inter-professional Teaching Award	11
○ NHG Outstanding Education Partners Award	5
○ NHG Teaching Award for Senior Doctors	25
○ NHG Teaching Award for Junior Doctors	20
○ NHG Teaching Award for PGY1s	10
○ NHG Outstanding Nurse Teachers Award	19
○ NHG Teaching Award for Nursing Preceptors	48
○ NHG Teaching Award for Pharmacy Senior Preceptors	9
○ NHG Teaching Award for Pharmacy Preceptors	6
○ NHG Teaching Award for Allied Health Senior Educators	15
○ NHG Teaching Award for Allied Health Educators	15
NHG QUALITY DAY AWARDS 2019	58
○ Excellence in Action Award (EIAA)	31
○ Exemplary Patient & Caregiver Award (EPCA)	6
○ Quality Improvement Award (QIA)	21


* Contact Centre Association of Singapore (CCAS)
 ^ Health Manpower Development Plan (HMDP)



“ We need all hands on deck to help us navigate this crisis and explore new solutions and strategies and carve a niche for ourselves. Everyone has a stake in this country and it is up to us to make Singapore a better place.”

PRESIDENT HALIMAH YACOB





“ As with dark clouds and storms, sunshine will prevail eventually. I therefore urge each one to hold up the *Torch of HOPE* and I have faith that we will emerge out of this pandemic, wiser and humble with many lessons learnt for humanity, and apply them in our world of healthcare.

PROFESSOR PHILIP CHOO
GROUP CEO, NHG

ABOUT OUR INSTITUTIONS



TAN TOCK SENG HOSPITAL

11 JALAN TAN TOCK SENG
SINGAPORE 308433
TEL: 6256 6011
FAX: 6252 7282
www.ttsh.com.sg

Tan Tock Seng Hospital (TTSH) is the flagship hospital of NHG and part of Singapore's public healthcare system. As a pioneering hospital with strong roots in the community for over 175 years, TTSH is recognised as the People's Hospital, serving a resident population of 1.4 million living in Central Singapore.

Together, with 70 community partners and 80 community health posts, it brings care beyond the hospital into the community as an Integrated Care Organisation – Central Health.

As one of the largest multi-disciplinary hospitals in Singapore, TTSH operates more than 1,700 beds with centres of excellence including the National Centre for Infectious Diseases (NCID), Institute for Geriatrics & Active Ageing (IGA), NHG Eye Institute (NHGEI), TTSH Rehabilitation Centre, and Ang Mo Kio Specialist Centre (AMKSC).

TTSH's 600-bed Integrated Care Hub will be ready in 2023 to provide for subacute care and rehabilitation. As a healthcare leader in population health, systems innovation, health technologies and workforce transformation, TTSH hosts Singapore's largest purpose-built innovation centre for healthcare – the Ng Teng Fong Centre for Healthcare Innovation (CHI) and its Co-Learning Network of 37 local and international partners.



KHOO TECK PUAT HOSPITAL

90 YISHUN CENTRAL
SINGAPORE 768828
TEL: 6555 8000
FAX: 6602 3700
www.ktph.com.sg

Khoo Teck Puat Hospital (KTPH) is a 795-bed general and acute care hospital which opened in June 2010. Serving more than 550,000 people living in the north of Singapore, KTPH combines medical expertise with high standards of personalised care, set within a healing environment, to provide care that is good enough for our own loved ones. From intuitive wayfinding to logical clustering of services, KTPH's design is focused on providing a hassle-free experience for patients.

The hospital has been designed with patients' comfort in mind. Since its opening, the building has garnered numerous awards for its green and energy efficient design. Patients can enjoy comfortable accommodation in different categories of wards with views of greenery and naturally cool air from improved ventilation. KTPH also provides a wide range of outpatient specialist services.



WOODLANDS HEALTH CAMPUS

CORPORATE OFFICE
 9 MAXWELL ROAD
 MND COMPLEX ANNEX A
 #03-01A
 SINGAPORE 069112
 TEL: 6681 5999
www.whc.sg

Woodlands Health Campus (WHC) is a 1,800-bedded purpose-built Campus comprising a fully integrated acute and community hospital, specialist outpatient clinics, and intermediate and long-term care facilities. It is slated to open progressively from 2023.

WHC aims to reinvent the way care is delivered and provide seamless integration of care within and beyond hospital walls. To achieve this, WHC will be leveraging SMART technology to enhance care within the hospital, and extend the reach of WHC healthcare professionals into the community to partner and empower residents in their health journey. Work has already begun at WHC pre-operations wards to test innovation and user-friendly solutions for inpatient care, emergency medicine, pharmacy, logistics and the community.

WHC has also started serving the community through health talks, fitness sessions, health coaching and community nursing posts. In September 2020, WHC introduced the GPFIRST Programme in the North and opened the first community-based Urgent Care Centre at Kampung Admiralty, making urgent care more accessible to residents living nearby.



INSTITUTE OF MENTAL HEALTH

BUANGKOK GREEN MEDICAL PARK
 10 BUANGKOK VIEW
 SINGAPORE 539747
 TEL: 6389 2000
 FAX: 6385 1050
www.imh.com.sg

The Institute of Mental Health (IMH) is a 2,000-bed acute tertiary psychiatric hospital. Set amidst 23 hectares of serene surroundings, IMH offers a multidisciplinary and comprehensive range of psychiatric, rehabilitative, and counselling services in both hospital and community-based settings to meet the needs of children and adolescents, adults, and the elderly. Besides providing patient-centred clinical services, IMH trains the current and next generation of clinicians, nurses, and allied health professionals in psychiatry and conducts research related to mental health.



YISHUN COMMUNITY HOSPITAL

2 YISHUN CENTRAL 2
SINGAPORE 768024
TEL: 6807 8800
www.yishuncommunityhospital.com.sg

Yishun Community Hospital (YCH) is a 224-bed hospital which provides intermediate care for recuperating patients who do not require the intensive services of an acute-care hospital. Opened in November 2016, YCH provides a range of services from rehabilitation and sub-acute care to geriatric, dementia and palliative care services, to help support the growing ageing population in Singapore.



NATIONAL HEALTHCARE GROUP POLYCLINICS

HEADQUARTERS
3 FUSIONOPOLIS LINK #05-10
NEXUS@ONE-NORTH (SOUTH LOBBY)
SINGAPORE 138543
CONTACT CENTRE: 6355 3000
www.nhgp.com.sg

National Healthcare Group Polyclinics (NHGP) forms the primary healthcare arm of NHG. Its six polyclinics serve a significant proportion of the population in the central and northern parts of Singapore.

NHGP provides a comprehensive range of health services for the family, functioning as a one-stop health centre providing treatment for acute medical conditions, management of chronic diseases, women & child health services, and dental care. The focus of NHGP's care is on health promotion and disease prevention, early and accurate diagnosis, disease management through physician led team-based care, as well as enhancing the capability of Family Medicine through research and teaching.

Through the Family Medicine Academy and the NHG Family Medicine Residency Programme, NHGP plays an integral role in the delivery of Primary Care training at medical undergraduate and post-graduate levels. With the Primary Care Academy, NHGP provides training to caregivers and other primary care counterparts in the community sector.



NATIONAL SKIN CENTRE

1 MANDALAY ROAD
SINGAPORE 308205
TEL: 6253 4455
FAX: 6253 3225
www.nsc.com.sg

The National Skin Centre (NSC) is an outpatient specialist dermatological centre with a team of dermatologists who have the experience and expertise to treat a wide variety of skin conditions. The Centre also aims to facilitate subspecialisation and be the national focus for the treatment, research, and training on all aspects of skin diseases.

With a comprehensive range of subspecialty services, and serving about 80 per cent of dermatology outpatients in Singapore, NSC is firmly established as a reputable dermatology centre in Singapore and the region. NSC also collaborates with the Agency for Science, Technology and Research (A*STAR) and Nanyang Technological University (NTU) to operate the Skin Research Institute of Singapore (SRIS), which focuses on conducting high impact, inter-disciplinary skin research designed to translate into improved health outcomes and quality of life.



NATIONAL CENTRE FOR INFECTIOUS DISEASES

16 JALAN TAN TOCK SENG
SINGAPORE 308442
TEL: 6256 6011
www.ncid.sg

The National Centre for Infectious Diseases (NCID) is a purpose-built facility designed to strengthen Singapore's capabilities in infectious disease management and prevention. NCID houses clinical services, public health, research, training and education, and community engagement functions under one overarching structure. In addition to the clinical treatment of infectious diseases and outbreak management, the expanded roles and functional units of NCID include the National Public Health and Epidemiology Unit, the National Public Health Laboratory, the Infectious Disease Research and Training Office, the Antimicrobial Resistance Coordinating Office, and the National Public Health programmes for HIV and Tuberculosis. Benchmarked to international standards and best practices for treatment and safety, NCID will better enhance Singapore's ability to respond effectively to infectious outbreaks.



ADMIRALTY MEDICAL CENTRE

676 WOODLANDS DRIVE 71 #03-01
 KAMPUNG ADMIRALTY SINGAPORE 730676
 TEL: 6807 8000
 www.admiraltymedicalcentre.com.sg

Admiralty Medical Centre (AdMC) is a one-stop medical centre for outpatient clinic consultation, day surgery, rehabilitation and diagnostic services, as well as community health outreach activities. It provides selected specialist outpatient services, day surgery procedures and endoscopies for patients. The medical and surgical services are run by clinical departments from Khoo Teck Puat Hospital. AdMC aims to provide hassle-free, holistic specialist care in a convenient community setting in collaboration with other healthcare partners.



INSTITUTE OF GERIATRICS AND ACTIVE AGEING

CENTRE FOR GERIATRIC MEDICINE
 TEL: 6359 6100 FAX: 6359 6101

The Institute of Geriatrics and Active Ageing (IGA) was set up to establish new directions for geriatric care in Singapore. Through research innovations and continuous education, the Institute aims to enable the delivery of holistic care to improve the health, independence, safety, and quality of life for the elderly.



NATIONAL HEALTHCARE GROUP DIAGNOSTICS

3 FUSIONOPOLIS LINK #05-08
 NEXUS@ONE-NORTH (SOUTH TOWER)
 SINGAPORE 138543
 CALL CENTRE: 6275 6443 (6-ASK-NHGD)
 www.diagnostics.nhg.com.sg

National Healthcare Group Diagnostics (NHGD) is a business division of NHG, providing quality laboratory and imaging services at the primary healthcare level. Via its extensive network of over 30 imaging centres, laboratories and a fleet of mobile service vehicles, NHGD provides one-stop imaging and laboratory services that are accessible, cost-effective, timely, seamless, and accurate. In a continuous quest for quality excellence, NHGD received international accreditation such as ISO 15189 for medical laboratories and medical imaging.

Urgent Care Centre
 @ Admiralty

URGENT CARE CENTRE @ ADMIRALTY

676 WOODLANDS DRIVE 71 #01-01
 KAMPUNG ADMIRALTY SINGAPORE 730676
 TEL: 6363 3000
 www.whc.sg/feelingunwell/urgent-care

The Urgent Care Centre at Kampung Admiralty (UCC @ Admiralty) provides consultations for urgent but not life-threatening acute medical conditions requiring intermediate level of care, and treatments such as application of splint or cast for simple fractures and dislocations, stitching for cuts and wounds, and administration of intravenous fluid. Located in the community, the UCC makes urgent care more accessible to residents living nearby, without them having to visit the hospital emergency department (ED). The UCC @ Admiralty is an initiative by WHC in partnership with KTPH.



NHG PHARMACY

3 FUSIONOPOLIS LINK #05-07
 NEXUS@ONE-NORTH (SOUTH LOBBY)
 SINGAPORE 138543
 TEL: 6340 2300
 www.pharmacy.nhg.com.sg

National Healthcare Group Pharmacy (NHGPh), a business unit of NHG, provides a wide range of pharmacy services to meet the needs of the community. Our pharmacies offer trusted services to help the community use their medication in a safe, effective, and responsible manner. As the leading provider of pharmacy services in the long-term care sector, we actively address the needs of the senior community and their caregivers. Our team of pharmacists provides clinical pharmacy services to help customers achieve the best results for their prescribed therapy by working with other members of the healthcare team. Customers can seek advice on medication and purchase quality and affordable healthcare essentials from our retail branches and online store.



NHG COLLEGE

3 FUSIONOPOLIS LINK #03-08
 NEXUS@ONE-NORTH (SOUTH LOBBY)
 SINGAPORE 138543
www.college.nhg.com.sg

NHG College plays an instrumental role in facilitating continuous learning and development of our workforce, as well as driving leadership development in NHG. NHG College taps into our internal expertise, and collaborates with renowned institutions and industry partners to build collective capabilities of NHG leaders, educators, healthcare professionals, and staff, to improve the health of our patients and the community.



NHG EYE INSTITUTE

TEL: 6357 8000
www.tei.nhg.com.sg

The NHG Eye Institute (NHGEI) was set up to meet the increasing demand for eyecare services. By combining the clinical expertise and facilities across NHG Institutions, it is able to achieve greater synergy and provide quality eye care to patients. It also works with various organisations – such as the Singapore Eye Research Institute, National University of Singapore and clinical research organisations – to undertake clinical research programmes relevant to its patients.



NHG HEART INSTITUTE

Established on 1 June 2019, the NHG Heart Institute encompasses the cardiology departments of Tan Tock Seng Hospital, Khoo Teck Puat Hospital and Woodlands Health Campus. It seeks to strengthen the practice of cardiology across NHG through good clinical and administrative governance, consistency in standards of care, and harmonisation of manpower to facilitate right-siting of services and provide evidence-based care. It also serves as a platform for collaboration and coordination for clinical practice, research, education, training, and population health. NHG Heart Institute will partner providers in Primary Care to deliver seamless care and transition for our patients in the community.

USEFUL LINKS & HELPLINES

MENTAL HEALTH

- IMH Mental Health Helpline: 6389 2222
- Samaritans of Singapore (SOS) Hotline: 1800 221 4444
- Singapore Association for Mental Health (SAMH) Helpline: 1800 283 7019
- National CARE Hotline: 1800 202 6868
- Silver Ribbon (Singapore): 6386 1928
- Community Health Assessment Team (CHAT): 6493 6500 / 6501
- Community Wellness Clinics (CWCs)
 - Geylang Polyclinic, 21 Geylang East Central, Singapore 389707
 - Queenstown Polyclinic, 580 Stirling Road, Level 4, Singapore 148958

CAREGIVER SUPPORT

For caregivers to persons with mental illness:

Caregiver Alliance: 6460 4400 or visit www.cal.org.sg

For caregivers to the elderly:

- The Seniors Helpline: 1800 555 5555
- Singapore Silver Line: 1800 650 6060
- Alzheimers' Disease Association Singapore Helpline: 6377 0700 or visit www.alz.org.sg
- Caregiving Welfare Association: 6466 7957 / 7996 or visit www.cwa.org.sg
- Touch Caregivers Support: 6804 6555 or visit www.caregivers.org.sg
- Agency For Integrated Care (AIC): 1800 650 6060 or visit www.AIC.sg
- Tsao Foundation: 6593 9500 or visit www.tsaofoundation.org
- Sage Counselling Centre: 6354 1191 or visit www.sagecc.org.sg

HOSPICE & PALLIATIVE CARE

- Singapore Hospice Council: 6538 2231 or visit singaporehospice.org.sg
- Dover Park Hospice: 6500 7272 or visit www.doverpark.org.sg
- HCA Hospice Care: 6251 2561 or visit www.hca.org.sg

CELEBRATING TWO DECADES OF HEALTHCARE EXCELLENCE

2000

MAR 2000
National Healthcare Group (NHG) is formed



JUL 2002
NHG College officially opens



JUL 2010
Official opening of National Addictions Management Service (NAMS) Clinic

NOV 2010
Official opening of Khoo Teck Puat Hospital (KTPH)



MAY
LKC Medicine Ground Breaking ceremony of Novena campus



MAR 2003
Tan Tock Seng Hospital (TTS) is designated the hospital to combat SARS in Singapore

MAR 2004
National Skin Centre (NSC) rolls out its first fully integrated Electronic Medical Records (EMR) in Singapore



2006
NHG Diagnostics (NHGD) launches Mammobus and mobile diagnostic services

OCT 2010
Collaboration Agreement signed by Nanyang Technological University (NTU) and Imperial College London, marking the founding of Lee Kong Chian School of Medicine (LKCMedicine)

2012

MAY
NHG Pharmacy (NHGPh) launches ConviDose Medication Management System

JUL
NHG and TTSH open Simulation and Integrated Medical Training Advancement Centre (SIMTAC)



2014

SEP
TTSH launches Outpatient Pharmacy Automation System (OPAS)

SEP
Launch of Rehabilitation Research Institute Singapore (RRIS)

JUL
TTSH opens Centre for Geriatric Medicine

MAR
NHG launches 4P7R Book - *Our Shared Stories, Same Same Yet Different, Our Shared Future*

SEP
Launch of Skin Research Institute of Singapore (SRIS)



AUG
NHG launches HealthCity Novena



APR
Ang Mo Kio Family Medicine Clinic (FMC) opens



2013

OCT
NHG launches 4 Principles & 7 Rules, Our Shared Future (4P7R)

2015

JAN
Change of Leadership - Prof Philip Choo, new Group CEO, NHG

MAY
NHG's 15th Anniversary Celebration



NOV
NHG launches first phase of three-year Population Health Survey

AUG
NHG celebrates - commemorates NHG15 stamps and We Walk 50km Together

2016

2016
Singapore Mental Health Study 2016 commenced, results announced in 2018



2016
NHG Group Education goes Digital - eLearning platform

JAN
NHG welcomes first pharmacy residents



JAN
NHG publishes *Conversations On First Steps: Our Regional Health System* book

FEB
NHG launches first Mobile Community Health Centre

JAN
National Healthcare Group Polyclinics (NHGP) and NSC embark on a pilot at Hougang Polyclinic to provide Tele-DERM services

SEP
NHGP setup Care F

OCT

Harmonisation of NHG House Brands

OCT
NHG and Alexandra Health System (AHS) officially amalgamate as One NHG Family

OCT

NHG signs a Memorandum of Understanding (MOU) with NTU and Dover Park Hospice to establish The Palliative Care Centre for Excellence in Research and Education (PaC)

SEP

Expansion of Programme Dignity - first-of-its-kind home-based palliative care programme

AUG

Official Opening of LKCMedicine

APR

Groundbreaking of Woodlands Health Campus (WHC)



NOV

Official opening of Yishun Community Hospital (YCH)

partners LKCMedicine in the of the Centre for Primary Health Research and Innovation

NOV

KTPH is awarded the inaugural Stephen R. Kellert Biophilic Design Award

NOV

KTPH is awarded the President's Award for the Environment



DEC

NHGP and NHGPh set up a Medication Clinic to improve the transition of care for patients discharged from hospital to primary care



MAR

Groundbreaking of the Integrated Care Hub at HealthCity Novena

JAN

Reorganisation of public healthcare system to three clusters

2017



JUL

NHGP implements a One-Queue System at all its polyclinics

JUL

Convocation ceremony of LKCMedicine's inaugural cohort

APR

NSC 30th Anniversary and Groundbreaking ceremony of new NSC building

JAN

NHGD, Singapore Cancer Society (SCS) and Breast Cancer Foundation (BCF) launch the Community Mammobus Programme

2018

2018
WHC sets up SMART Community Nursing team and Community Nurse posts, benefiting over 1,300 residents in Woodlands since 2018



NOV

Official opening of P.H. Feng Research Centre

2020

2020
IMH commemorates 50 years of child psychiatry since the opening of Child Guidance Clinic

2020
NHG Group Education celebrates its 10th Anniversary



2020
NHGP celebrates its 20th Anniversary

MAR

NHG Group Research obtains re-accreditation from the U.S. Association for the Accreditation of Human Research Protection Programs (AAHRPP)



NOV

KTPH marks its 10th Anniversary

APR

Ang Mo Kio Polyclinic implements Blister Pack Picking Machine to drive up automation

APR

NHG commemorates its 20th Birthday

JUL

TTSH commemorates its 176th Anniversary



2020

2019

OCT

Institute of Mental Health (IMH) celebrates its 90th Anniversary with a Charity Concert



JUL

Inaugural cohort graduates from the National Collaborative Prescribing Programme

APR

NHG forms Central North Primary Care Network (CN-PCN)

JAN

Formation of the new NHG-Johns Hopkins Singapore Institute

APR

Paya Lebar Methodist Girls' School (PLMGS) and NHG join forces to improve school health

MAY

Official opening of Ng Teng Fong Centre for Healthcare Innovation (CHI)

JUL

TTSH celebrates 175 years

NOV

NTU, National Neuroscience Institute (NNI) and NHG launch the Brain Bank Singapore

NOV

Launch of Core Values at NHG Culture Symposium



APR

Official opening of HealthCity Novena Link

MAY

Launch of *River Of Life: NHG's Perspectives on Population Health* book



SEP

Official Opening of National Centre for Infectious Diseases (NCID)

