



National Centre for  
Infectious Diseases



**A NEW BEGINNING,  
A DEFINING CHALLENGE**  
YEARBOOK 2020



## MISSION

Protecting the people of Singapore from infectious diseases



## VISION

Strong, trusted and united in keeping Singapore safe from infectious diseases



## CORE VALUES

### **Nurturing**

We foster growth within a safe and supportive environment

### **Compassion & Collaboration**

We care for everyone and work with all

### **Integrity & Innovation**

We do the right things and embrace creativity

### **Dedication**

We are ready to respond anytime

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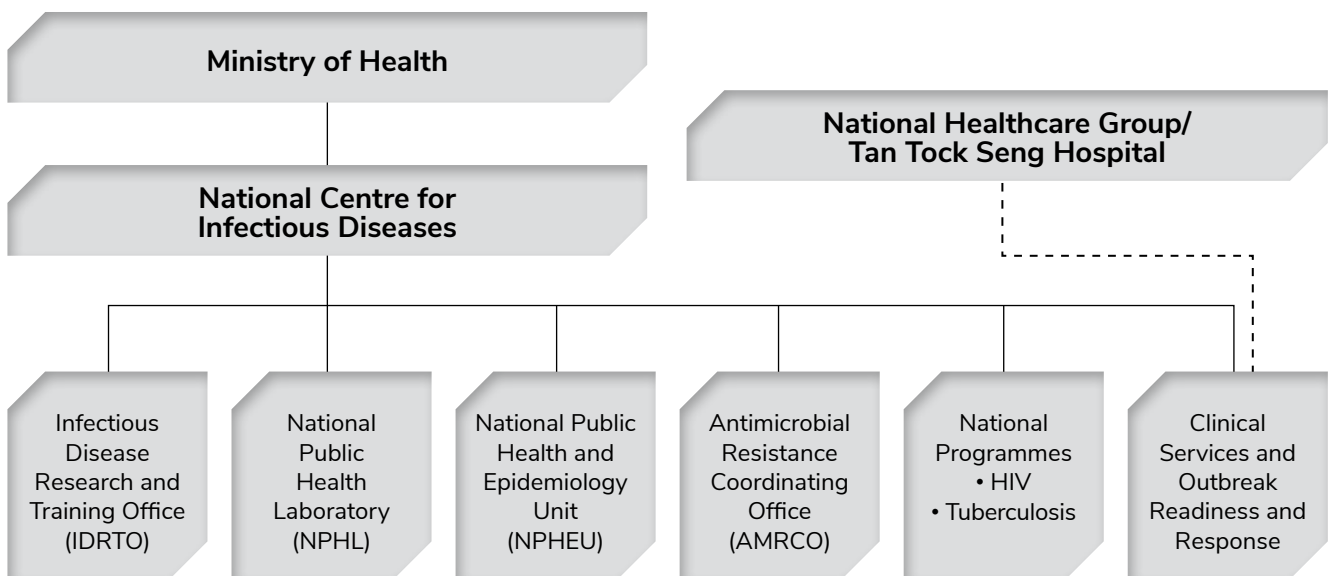


# ABOUT NCID

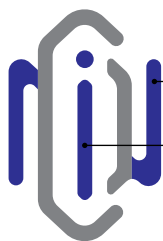
In the last 20 years, the world has seen outbreaks from Nipah and SARS to Ebola and Zika. The threat of emerging infectious disease outbreaks is real. To combat infectious diseases at a national level, the National Centre for Infectious Diseases (NCID) was conceived. NCID is the result of years of hard work to build our capabilities to provide the best patient care and safeguard Singapore in an event of an outbreak.

The 330-bed purpose-built facility is 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 within 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 Infectious Disease Research and Training Office, the National Public Health Laboratory, the National Public Health and Epidemiology Unit, the Antimicrobial Resistance Coordinating Office, and the national public health programmes for Human Immunodeficiency Virus (HIV) and Tuberculosis.

With its state-of-the-art facilities and comprehensive clinical and public health capabilities in infectious disease prevention, control, and management, NCID looks forward to playing a leading local, regional and global role in protecting the health of Singaporeans and global citizens.



— Direct Reporting Line  
- - - Secondary Reporting Line



**The Shield**  
Protection & Strength

**Human**  
Leadership & Innovation

The logo of the National Centre for Infectious Diseases is represented by a shield with people at the centre. It is formed from its acronym NCID with N, C, D making up the shield which stands for protection and strength. The character “I” in the middle represents the human element, synonymous with leadership and innovation. Overall, the logo amplifies NCID’s role of protecting the nation from infectious diseases.



## MESSAGE



The National Centre for Infectious Diseases (NCID) was established to strengthen Singapore's capabilities in infectious disease prevention, management, and public health preparedness. The vision for a new national centre to manage infectious diseases was conceived more than two decades ago. In 2014, we bore witness to the ground breaking ceremony for NCID and within a span of five years, the grand addition to the HealthCity Novena was completed. We moved from the Communicable Disease Centre (CDC) to this state-of-the-art facility in November 2018, and NCID was officially opened on 7 September 2019.

Within the first year at our new facility, NCID's capabilities were truly put through their paces. We received the first monkeypox case in Asia in May 2019, followed by a local surge of measles cases in June and July 2019. These incidences were the first tests of NCID's infrastructure, co-ordination and teamwork in outbreak response. When COVID-19 hit our shores in January 2020, NCID was called on to be at the forefront of Singapore's outbreak efforts. We waged war against these diseases with three weapons: preparation, knowledge and collaboration.

Preparation is key. Our unique integrated approach of having clinical care, public health, research, training and education, and community engagement functions under one overarching structure serves as the foundation to achieve our mission to protect the people of Singapore from infectious diseases. NCID provides specialised, multidisciplinary outpatient and inpatient infectious



disease care. Our public health units conduct surveillance and epidemiological investigations into diseases of public health importance, support outbreak investigations through specialised laboratory tests, coordinate the national response to antimicrobial resistance across sectors, and drive national initiatives for Tuberculosis and Human Immunodeficiency Virus (HIV). NCID also plays an active role in coordinating and facilitating infectious disease research, training and education to prepare Singapore for outbreaks. The work we do as a united and committed team, and the outbreak training we receive in peacetime, make us ready to combat any infectious disease outbreak.

Another essential component of our battle-readiness is having knowledge of our enemy – in this case, novel or known pathogens that cause infectious disease outbreaks. Singapore's experience in battling Severe Acute Respiratory Syndrome (SARS), and the current COVID-19 pandemic has taught us that infectious diseases are borderless and recognise no distinctions in socio-demographics when they strike. To boost outbreak readiness and to be able to mobilise national defense effectively against emerging infections, NCID will continue to establish clinical networks involving clinicians in Infectious Diseases, Intensive Care, Emergency Medicine, Epidemiology, Primary Care and other relevant partners. It is important to continually build the knowledge needed to combat infectious diseases, and never stop seeking solutions and forging partnerships in this battle.

Collaboration on the ground is also key. To effectively counter emerging infections at every level of society, we will continue to be ever mindful that community resilience is critical. To this end, we will continue to collaborate with community partners to raise awareness and promote counter-measures such as vaccination and appropriate use of antibiotics. We must also strive to improve our pandemic and outbreak preparedness through national, regional and international partnerships, which provide energy and synergy in ensuring our research landscape grows ever richer.

This is NCID's first yearbook, and documents our efforts and achievements since our official opening in September 2019. We also highlight some key milestones from the time we moved to NCID in November 2018 to before our official opening. We would like to take the opportunity to thank all our collaborators and partners from Tan Tock Seng Hospital, all public healthcare institutions, academic centres, research institutions, ministries and all who were involved in the successful set-up and operation of NCID.

In the years to come, NCID will continue to achieve our vision and mission, and develop into a renowned centre for infectious diseases, playing a critical role on the international stage.

**Professor Leo Yee Sin**  
Executive Director  
National Centre for Infectious Diseases





## MESSAGE



The official opening of the National Centre for Infectious Diseases (NCID) in September 2019 marked a milestone in Singapore's outbreak preparedness, and proved to be very timely when the COVID-19 pandemic arrived on our shores barely four months later. NCID together with Tan Tock Seng Hospital (TTSH) became the epicentre of the national COVID-19 response, and were quick to integrate clinical and operational support including manpower, expertise, and resources. Collaborating closely with the Multi-Ministry Taskforce and the Ministry of Health (MOH) in diagnostics, epidemiology investigation, disease mapping, and surveillance, NCID has helped brace the whole-of-nation effort to contain the epidemic in Singapore.

Taking over the functions of the former Communicable Disease Centre (CDC), NCID is the fruition of years of detailed planning and hard work by National Healthcare Group (NHG), TTSH, government agencies, medical and research institutions, and healthcare partners. It comprises the nation's collective dedicated resource for the integration of clinical

services, public health functions, and research excellence in infectious diseases management and outbreak readiness. This integrated approach was the foundation for the successful management of the first imported case of monkeypox and the measles outbreaks in 2019.

Since the first COVID-19 case was detected in Singapore on 23 January 2020, our NHG Family has rallied as one, working tirelessly to care for affected patients and to keep the mortality rate low. Clinical and non-clinical staff from Yishun Health, Woodlands Health Campus, National Healthcare Group Polyclinics, National Skin Centre, Institute of Mental Health, NHG Pharmacy, NHG Diagnostics, and NHG HQ have stood with TTSH-NCID in solidarity to manage the crisis.

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. NCID not only had to open up its 330 beds more quickly than anticipated, it also had to expand capacity to accommodate more patients and ramp up training for

staff to cope with the huge surge in infections. Toiling behind the scenes, NCID researchers surfaced new and critical knowledge and evidence about the disease to advance clinical management and policy decisions locally, as well as collaborated with global medical and scientific centres to develop treatments and to find a cure for COVID-19.

Though the number of COVID-19 infections has been brought under control as the nation rolls out its vaccination programme, we must remain vigilant. I am immensely proud of the NCID management and staff, with the support of other NHG Institutions, for their collective leadership in caring for patients, and sharing knowledge on COVID-19 through public education and webinars, with the view of giving our best to Singapore as well as the world.

This has indeed been a very challenging time. But the unprecedented crisis has catalysed us to achieve things we thought impossible, simplified tedious processes, accelerated solutions to nagging problems, learnt, coached, and grown exponentially as an organisation, as ONE Family. I salute all our frontline heroes for your professionalism, dedication and grit. I am also grateful for the unwavering support from our non-clinical staff, including business partners and friends in the community who have brought us much cheer and hope, and kept us resolute and resilient in overcoming tough times.

Together, we shall emerge stronger as a nation from this crisis.

**Professor Philip Choo**  
Group Chief Executive Officer  
National Healthcare Group



## MESSAGE



This short message would not be complete without acknowledging the National Healthcare Group (NHG) and Tan Tock Seng Hospital (TTSH). NCID had its beginnings as part of TTSH and the staunch and committed support of the staff and leadership have been the foundation, together with the guidance and strong assistance of NHG.

It leaves me to congratulate the leadership and staff for an eventful and meaningful year past and to wish the wonderful team at NCID every success as they work to help our country weather and overcome the current COVID-19 challenge.

I am honoured and pleased to be asked to pen a short message to National Centre for Infectious Diseases (NCID) for her inaugural corporate yearbook. And what 2020 has been for our newest national centre. COVID-19 impacted us this past year. It bears remembering that the team at NCID only moved into the new facilities on November 2018 and NCID officially opened on 7 September 2019! These facilities include the high level isolation facility purpose built to manage highly infectious and dangerous infections, a timely and needed capability for Singapore.

While NCID is associated with clinical care of patients with infectious diseases, it is also home of the National Public Health and Epidemiology Unit, the National Public Health Laboratory, the Infectious Disease Research and Training Office and the Antimicrobial Resistance Coordinating Office. Hence, it has a comprehensive range of capabilities to deal with myriad infectious disease risks at many levels, including housing the programmes for Tuberculosis and

Human Immunodeficiency Virus (HIV). Such a comprehensive facility allows for an end to end delivery of capabilities to deal with infectious diseases.

What is significant, though, is that NCID has risen to the task of helping the nation and the Ministry of Health (MOH) to anchor both the care and response to COVID-19 throughout 2020 into 2021. Even prior to this, NCID was able to detect and manage a case of monkeypox. In fact, in my recollection, even as the staff started to move into the new building, emerging infectious diseases needed their attention. As a national centre, the close working relationship with the MOH is a special one that marks this facility.

Looking back at the many discussions and plans that were necessary to lead to the development of this centre, the staff at NCID should be justly proud of where they are today. Regardless, the team here now needs to continue to actively work to be part of the capabilities that enable Singapore to get back to a more normal life.

**Associate Professor Benjamin Ong**  
*Senior Vice President (Health Education and Resources)*  
*National University of Singapore*  
*& Senior Advisor to the*  
*Director of Medical Services*  
*Ministry of Health, Singapore*



## LEADERSHIP TEAM



(LEFT TO RIGHT)

**Associate Professor David Lye**  
Director, Infectious Disease Research and Training Office (IDRTO)

**Adjunct Assistant Professor Shawn Vasoo**  
Clinical Director

**Professor Leo Yee Sin**  
Executive Director

**Associate Professor Raymond Lin**  
Director, National Public Health Laboratory

**Adjunct Associate Professor Matthias Paul Toh**  
Director, National Public Health and Epidemiology Unit (NPHEU)



(LEFT TO RIGHT)

**Associate Professor Jeffery Cutter**  
Acting Director, National Tuberculosis Programme

**Associate Professor Sophia Archuleta**  
Director, National HIV Programme

**Dr Margaret Soon**  
Director, Nursing

**Adjunct Assistant Professor Monica Chan**  
Head, Department of Infectious Diseases

**Mr Albert Tan**  
Director, Operations

**Dr Lee Tau Hong**  
Head, Antimicrobial Resistance Coordinating Office





(LEFT TO RIGHT)

**Adjunct Assistant Professor Wong Chen Seong**  
Deputy Director, National HIV Programme

**Dr Deborah Ng**  
Deputy Director, National Tuberculosis Programme

**Dr Ho Lai Peng**  
Principal Medical Social Worker

**Ms Law Hwa Lin**  
Principal Pharmacist (Specialist)

**Adjunct Assistant Professor Kalisvar Marimuthu**  
Clinical Lead, Hospital Associated Infections, NPHEU



(LEFT TO RIGHT)

**Dr Barnaby Edward Young**  
Head, Singapore Infectious Disease Clinical Research Network, IDRTO

**Dr Mark Chen**  
Head, NCID Research Office, IDRTO

**Dr Tan Seow Yen**  
Head, Training and Education Office, IDRTO

**LEADERS WHO HAVE STEPPED DOWN IN 2020**

**Associate Professor Angela Chow**  
Director, NPHEU

**Associate Professor Yeo Tsin Wen**  
Deputy Head, National Infectious Disease Research Coordinating Office, IDRTO

**Professor Paul Anantharajah Tambyah**  
Head, National Infectious Disease Research Coordinating Office, IDRTO



## ADMINISTRATIVE TEAM



(LEFT TO RIGHT)

**Professor Leo Yee Sin**  
Executive Director

**Mr Albert Tan**  
Director, Operations

**Ms Farah Binte  
Mohamed Haniff**  
Director, Research Operations,  
Infectious Disease Research  
and Training Office

**Ms Marion Abraham**  
Deputy Director,  
Corporate Communications



(LEFT TO RIGHT)

**Mr Yee Chi-Yan**  
Assistant Director,  
Corporate Development

**Ms Joy Jin Yi**  
Assistant Director,  
Finance

**Ms Low Pui See**  
Assistant Director,  
Human Resource

**Ms Hsieh I Jen**  
Assistant Director,  
Informatics



## FACILITIES AT NCID

NCID is built on a set of design principles that combines safety, capability, capacity and scalability, convertibility and connectivity, and equipped with state-of-the-art facilities. Together with a multidisciplinary and dedicated team with first-rate clinical, diagnostics, research and surveillance capabilities, NCID stands at the forefront to protect Singapore from infectious diseases.

As a self-contained facility, NCID is capable of managing infectious cases on-site and the entire building can be locked down for the safe management of highly infectious agents. This cuts down the likelihood of contaminating other care areas. Situated at the heart of HealthCity Novena, NCID is well-connected to Tan Tock Seng Hospital, the Lee Kong Chian School of Medicine and the Ng Teng Fong Centre for Healthcare Innovation for better collaboration and more coordinated operations.





# FACILITIES AT NCID

## INPATIENT FACILITIES



**17** Wards with **330** beds including:



**1**

High Level Isolation Unit

**4**

High Level Isolation rooms

**8**

Negative Pressure rooms



**5**

Negative Pressure Wards<sup>1</sup>

**100**

beds



**5**

Isolation Wards<sup>2</sup>

**100**

beds



**4**

Cohort Wards

**80**

beds including 16 Negative Pressure beds



**2**

ICU Wards

**38**

beds

<sup>1</sup> Comprising negative pressure rooms with anterooms

<sup>2</sup> Comprising negative pressure rooms without anterooms

## OTHER CLINICAL FACILITIES



Two Outpatient Clinics



Screening Centre



Two Operating Theatres



Satellite Diagnostic Laboratory



Pharmacy

## PUBLIC HEALTH FACILITIES



Biosafety Levels (BSL) 2 and 3 Reference Laboratories



BSL 2 Research Laboratory and Biorepository



P. H. Feng Research Centre (PHFRC)



NCID Research Clinic



Tuberculosis Treatment Facility



NCID Cares





Ultraviolet (UV) irradiation before being exhausted out of the facility. This prevents contaminated air in the room from flowing to other areas of the hospital, avoiding the potential transmission of diseases.

The negatively pressured isolation rooms with anterooms comes with self-closing inter-locking doors. When the door to the room is open, air from the anteroom is drawn into the patient's room. Similarly, the anteroom is negatively pressured in relation to the corridor. When the door from the corridor is opened, air flows from the corridor into the anteroom. The flow of air from the anteroom into the patient's room prevents outflow of infectious agents from the patient's room, thereby controlling the entry and exit of contaminated air. The anteroom provides a barrier against the potential loss of pressurization, and also functions as a controlled area where healthcare professionals can don Personal Protective Equipment before entering the patient's room.

## NEGATIVE PRESSURE ROOM

All patient rooms in NCID are designed to be negatively pressured in relation to the corridor (for rooms without an anteroom) or negatively pressured in relation to the anteroom (for rooms with an anteroom), and are equipped

with single pass air-conditioning system with separate air handling unit (AHU). The contaminated air in the room is sucked out by an exhaust system equipped with top-tiered High Efficiency Particulate Air (HEPA) filter capable of filtering 99.999% of particles and further treated with

## HIGH LEVEL ISOLATION UNIT (HLIU)

A specialised biocontainment unit designed to safely manage patients with suspected or confirmed infections involving High Level Isolation Pathogens (HLIP). HLIP include viral haemorrhagic fevers such as Ebola, smallpox or other biothreat agents. The HLIU is supported with a dedicated laboratory for processing of patient samples on-site, and macerators and hydrogen peroxide vapourisers for specialised decontamination and waste management. Each room in the HLIU is capable of providing intensive care and is equipped with ventilators and dialysis capability.



Photo Courtesy of Write Editions®



## FACILITIES AT NCID



### OUTPATIENT CLINIC J AND SPECIAL PRECAUTION AREA

Clinic J provides one-stop holistic, integrated and multidisciplinary specialist services including medical consultations, Pharmacy, Care and Counselling, and Diagnostic Radiology for outpatients with infectious disease conditions. A triaging system is in place to ensure that all patients



entering the clinic undergo pre-consult screening. Patients who are identified as requiring isolation precautions are escorted to a Special Precaution Area (SPA) where all services, including

consultation and treatment, X-ray and medication dispensing services will be rendered within the area to minimise patient movement.



### SCREENING CENTRE

The Screening Centre is a facility within NCID that is used for mass screening in the event of a disease outbreak. Equipped with infrastructure capabilities such as Sorting Area, Triage Zones, Waiting Areas, Consult Rooms, Procedure Rooms, Diagnostic Radiology, and Pharmacy, the Screening Centre is able to provide a one-stop suite of services. It is built with a special and dedicated AHU where air passes through HEPA filter and UV treatment. The Screening Centre also has negative pressure isolation rooms and resuscitation rooms, and it can be divided into separate zones where low-risk and high-risk patients can be channelled appropriately for investigations including observation of vital signs, blood test, X-ray and consultations.

## BIOSAFETY LEVEL 3 REFERENCE LABORATORY (BSL3 LAB)

High risk, novel or unknown biological agents will be investigated in the National Public Health Laboratory's (NPHL) - High Containment Facility (BSL3 Lab). The state-of-the-art BSL3 lab boasts box-within-box concept ensuring biocontainment and biosecurity, by safeguarding staff, materials and environment. Unique features of NPHL-BSL3 includes:

- Suites can be isolated and function independently within the facility
- Glovebox that can operate as a stand-alone biocontainment barrier equipment



- Powered Air-Purifying Respirators as standard respiratory protection gear for staff
- Various devices that enhance safety (e.g. man down alarm, gas detection) and security (access control, intrusion warning).



\* Photo was taken in 2019 before COVID-19

## NCID CARES

NCID Cares, previously known as the Patient Care Centre (PCC), is the community arm of NCID within the Infectious Disease Research and Training Office (IDRTO). It is a community space on level one of NCID and comprises a creative zone for patient volunteers to do handicrafts, a large dining area and a recreation zone "Great Minds" for volunteer-facilitated activities, training and programme-related events.





## FROM CDC TO NCID

Even though NCID was officially opened in September 2019, its roots go back more than 100 years. NCID's history began with the setting up of the Government Infectious Disease Camp in 1907. In 1913, it moved to Moulmein Road and was renamed Middleton Hospital in 1920. It remained the main hospital for infectious diseases and in 1985 was absorbed into Tan Tock Seng Hospital (TTSH) and renamed the Communicable Disease Centre (CDC). That same year, the first cases of Human Immunodeficiency Virus (HIV) infection were detected in Singapore. Subsequently, CDC became the primary institution for providing HIV patient care.

For more than a century, the CDC at Moulmein Road has been the centre of infectious disease outbreak management. But the world today is very much different from what it was. In recent years, the CDC was at the forefront of managing emerging infections – the Nipah virus outbreak in 1999, Severe Acute Respiratory

Syndrome (SARS) in 2003, and pandemic H1N1 in 2009 just to name a few. New infectious diseases continued to emerge, providing the impetus for the development of an infectious disease facility with enhanced capability and integrated functions of clinical care, public health, research, and training and education to combat infectious diseases at the national level.

### **BUILDING A FUTURE-PROOF INFECTIOUS DISEASES HOSPITAL**

The outbreak of SARS in 2003 highlighted the need to establish a new facility in close proximity to TTSH. In 2010, TTSH drew up the HealthCity Novena Master Plan 2030, an integrated medical hub that would include a world class infectious diseases hospital with a purpose-built facility for handling infectious disease outbreaks.





In 2014, then-Minister for Health Mr Gan Kim Yong officiated the ground-breaking ceremony for NCID. This was the culmination of many years of consultations and deliberations in planning for the new facility. The lessons learned from the emergence and management of SARS, H1N1 influenza, Zika virus and other infectious diseases were incorporated into the design of the self-contained facility which would allow for a lockdown of the building during a major outbreak while minimising the risk of transmission of highly contagious pathogens.

## MOVING WITH THE TIMES

NCID started its new chapter at 16 Jalan Tan Tock Seng – a 14-storey building with 330 beds designed to strengthen Singapore’s capabilities in infectious disease management and prevention.

Since late November 2018, NCID had been progressively opening its doors. Clinic J was the first facility to begin operations, offering outpatient infectious disease services. This was followed by the opening of the cohort and negative pressure wards and with the shifting of patients from CDC to NCID on 13 December 2018, we bade our final farewell to CDC at Moulmein Road.

From January 2019, operations were ramped up steadily with the gradual opening of public health and clinical laboratories, Screening Centre, operating theatres, Intensive Care Unit wards and isolation wards including the state-of-the-art High Level Isolation Unit. By mid-2019, NCID was fully operational, with new and enhanced outbreak management capabilities, poised to embark on the next phase of its journey to protect the people of Singapore against infectious diseases.



\* Photos were taken in 2018



# NEW BEGINNING, FRESH CHALLENGES

As NCID begins its journey, the ethos of duty and dedication to serve and protect the nation remains the same. The synergistic integration of clinical, research and public health functions under NCID has played a key role in the diagnosis and management of infectious diseases, enabling the centre to respond swiftly in a proactive and coordinated manner – from isolation and containment, detection and diagnosis, patient care, to screening of contacts and public education.

## RISING TO THE MONKEYPOX CHALLENGE

Barely a few months after moving into the new facility, NCID's capability in infectious disease surveillance, diagnosis and treatment was tested by an imported infectious disease. The patient was a Nigerian man who was in Singapore to attend a conference and he was diagnosed as Singapore's first imported case of monkeypox on 8 May 2019. He was first seen at Tan Tock Seng Hospital's Emergency Department and was swiftly admitted into one of the negative pressure rooms at NCID. The patient's samples were taken and sent to the National Public Health Laboratory (NPHL) for diagnosis, and NPHL confirmed the case as monkeypox via polymerase chain reaction (PCR) and electron microscopy (EM) in about 30 hours from the time the patient reached the centre. Close contacts were reviewed and offered vaccination, and the patient recovered after receiving treatment at NCID.

A crucial aspect of efficient outbreak management is high level of awareness, having the knowledge and technological capabilities, and expertise to detect and confirm previously unknown or rare pathogens. NPHL is the only facility for virus diagnosis in Singapore and one of a network of specialised EM labs in the world trained and prepared to look at Risk Group 3 (RG3) and emerging infectious disease (EID) agents. The incident demonstrated NPHL's capability in monitoring and diagnosing viruses and the ability of clinical and operations teams to work together to contain and treat emerging infectious diseases.

## NIPPING A MEASLES OUTBREAK IN THE BUD

An outbreak of measles at migrant worker dormitories and a home for the intellectually disabled demonstrated NCID's readiness and ability to mount a multidisciplinary approach to detect and contain infectious diseases and protect the community. In June 2019, NPHL which is the designated national reference laboratory for measles, was involved in detecting, diagnosing

and identifying the pathogen among some workers living in dormitories. The National Public Health and Epidemiology Unit, through data collection, was able to trace and identify the close contacts of index cases for vaccination exercises.

In order to ring fence and contain the virus, NCID worked with the Ministry of Health to conduct a series of mass vaccination operations in June and July for more than 2,000 people.



\* Photos were taken in 2019 before COVID-19





This included on-site vaccination conducted by NCID at the dormitories, and the screening of 600 close contacts at the Screening Centre. Throughout the measles vaccination exercise, Clinic J's Special Precaution Area maintained readiness to receive any incoming cases, for example, contacts who missed vaccination on-site.

### ACTIVATING HLIU

A key feature of NCID is Singapore's first High Level Isolation Unit (HLIU) to manage patients with suspected or confirmed infections involving High Level Isolation Pathogens (HLIP). HLIP include viral haemorrhagic fevers such as Ebola, smallpox or other biothreat agents. In June 2019, a patient from the Democratic Republic of Congo

was admitted with suspected Ebola virus disease. The HLIU was activated and clinical, laboratory, operations and supporting staff swung into action to manage this case. Subsequently, the patient was diagnosed with severe malaria and was transferred to and treated at a high dependency ward at NCID. The incident was a testament of NCID's ability to respond swiftly and decisively to any disease outbreak.



\* Photos were taken in 2019 before COVID-19





2019

M I L E S T O N E S

2020



# 2019

## 7 SEP 2019

### Official Opening of NCID

NCID was officially opened by then-Minister for Health, Mr Gan Kim Yong. The Official Opening was attended by some 200 guests from government, healthcare institutions, and research institutes and staff. A Community Open House aimed at engaging the community in building resilience against emerging infections was also organised. About 340 participants attended the Open House and learnt about hand hygiene, use of antibiotics, vaccinations, and common infectious diseases through the interesting booths and interactive games.



\* Photos from September 2019 to December 2019 were taken before COVID-19

## 18 – 24 NOV 2019

### World Antibiotic Awareness Week (WAAW) 2019

To commemorate World Antibiotic Awareness Week (WAAW), the Antimicrobial Resistance Coordinating Office (AMRCO) collaborated with the National University of Singapore (NUS) Saw Swee Hock School of Public Health to organise two community outreach events at Woodlands Regional Library which were attended by 600 adults and 800 children and supported by 100 volunteers. Participants learned about bacteria, antibiotics and hand hygiene at children activity booths and health talks.



## 30 NOV 2019

### Singapore HIV Congress 2019

NCID and partners jointly organised the Singapore HIV Congress 2019 themed "U = U : Science, not Stigma". Attended by close to 280 participants, this inaugural scientific congress brought together the medical, scientific and academic fraternity to discuss and provide updates on the latest in HIV medicine and related fields.



## 3 DEC 2019

### World AIDS Day Human Library Event

In conjunction with World AIDS Day, NCID organised a Human Library event to foster understanding of HIV and reduce prejudice and stigma that People Living with HIV (PLHIV) face. The event consisted of booths set up by healthcare workers caring for PLHIV as well as PLHIV and their families. Members of the public and staff could approach any of these booths to learn more about the disease and the stigma that people who work with PLHIV or PLHIV themselves face.



## 14 DEC 2019

### NCID Cares Embrace Charity Dinner

NCID Cares, previously known as the Patient Care Centre, organised the Embrace Charity Dinner raising a total of S\$265,000 for PLHIV. The funds raised will 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. The Guest-of-Honour was Dr Amy Khor, then-Senior Minister of State, Ministry of the Environment and Water Resources, and Ministry of Health. The event was attended by 300 guests including partners, stakeholders, and staff. A video "Three Decades of HIV Treatment and Care at the Communicable Disease Centre" was launched at the dinner. The video documents the stories of how four individuals who were closely involved in the treatment and care of PLHIV at the old CDC advocated to reduce stigma and improve treatment and care for PLHIV.



# 2020

## 22 JAN 2020

### Formation of the National COVID-19 Research Workgroup

NCID set up the National COVID-19 Research Workgroup (RWG) just one day before the first confirmed COVID-19 case was reported in Singapore. The RWG chaired by Professor Leo Yee Sin, NCID Executive Director and advised by Ministry of Health (MOH) Chief Health Scientist Professor Tan Chor Chuan, comprises members from NCID, Agency for Science, Technology and Research, NUS, Duke-NUS Medical School, MOH, National Research Foundation, National University Research (NUH), Nanyang Technological University, National Medical Research Council, DSO National Laboratories, Singapore Clinical Research Institute and National Healthcare Group. The Workgroup guided research efforts on COVID-19 which contributed to Singapore's success in managing and controlling the pandemic.



\* Photo taken before the implementation of safe distancing measures and mask mandate

## 23 JAN 2020

### Deployment of NPHL's SARS-CoV-2 PCR test

NPHL's laboratory-developed SARS-CoV-2 PCR assay, together with virus sequencing, was deployed to confirm Singapore's first COVID-19 case, a Chinese national from Wuhan.

## 24 JAN 2020

### NCID's first COVID-19 patient admitted

A traveller from China, the second confirmed COVID-19 case in Singapore, was the first confirmed case to be admitted to NCID.

## 29 JAN 2020

### 24-hour Screening Centre at NCID opens for screening of suspect cases

The Screening Centre at NCID, which was activated on 29 January, was the facility for the screening of suspect cases during the COVID-19 pandemic.



## 31 JAN 2020

### Prime Minister's visit

Prime Minister Lee Hsien Loong visited NCID. He was given a presentation on NCID's facilities and capabilities and the measures taken to manage the COVID-19 outbreak. He was shown the High Level Isolation Unit and Negative Pressure room and met some of the NCID frontline staff. The visit was a timely morale booster as NCID braced for the uncertainties of the outbreak. PM Lee thanked and expressed his respect for frontline healthcare workers for the difficult work that they had to do.



\* Photo taken before the implementation of safe distancing measures and mask mandate.

## 4 FEB 2020

### First recovered COVID-19 patient discharged from NCID.

## 7 FEB 2020

### NCID's first admitted COVID-19 patient discharged

NCID's first COVID-19 patient who was the second confirmed case in Singapore was discharged. The patient shared with the media her gratitude for the efforts and dedication of NCID's medical and nursing teams in treating and caring for her.

## 12 FEB 2020

### Visit by Co-chairs of Multi-Ministry Taskforce on COVID-19

Co-chairs of the Multi-Ministry Taskforce on COVID-19, then-Minister for Health, Mr Gan Kim Yong, and then-Minister for National Development, Mr Lawrence Wong visited NCID to understand how NCID was managing the outbreak and to meet NCID staff. They were updated on NCID's clinical and epidemiology research findings on patient profiling, risk stratification and management policies, as well as NCID-driven research including clinical trials. NCID shared the important findings on viral shedding which was a novel finding indicating viral transmission at early disease. These findings, subsequently published in JAMA, contributed to the local public health policies on disease prevention in Singapore.

## 1 MAR 2020

### COVID-19 Therapeutic workgroup

The COVID-19 Therapeutic workgroup, which is led by Clinical Director of NCID, was formed and comprises experts from various institutions such as NCID, Tan Tock Seng Hospital (TTSH), Singapore General Hospital (SGH), NUH and Health Sciences Authority (HSA).

## 11 MAR 2020

### Ramping up bed capacity

When the number of COVID-19 cases started rising in mid-March, NCID increased bed capacity by fitting an additional bed in the rooms. With this increase in capacity, NCID was able to provide tertiary care to more patients.



# 2020

## 19 MAR 2020

### Expansion of Screening Centre

To step up its capacity, the NCID Screening Centre expanded its operations by setting up a tent in an adjoining outdoor area which was ready for operations on 19 March. The Screening Centre's capacity was further expanded with modification to the existing tent on 24 April. Another tent was set up near the Ambulance Bay on 20 April.



## 20 MAR 2020

### First decant of recovering confirmed cases from NCID to Community Care Facilities

As the number of acute COVID-19 patients surged, those who were recovering well were sent to Community Care Facilities awaiting full recovery before being discharged. NCID worked with MOH to establish the workflow on transferring patients and to ensure quality care and infection control at the receiving sites.



## END APR – EARLY MAY

The bed occupancy in NCID was the highest at the end of April to early May, with around 500 patients warded.

## MID-MAY 2020

### Ramp down of COVID-19 outbreak wards

With the downward trending of COVID-19 confirmed cases in mid-May, NCID progressively reduced COVID-19 bed complement.

## 30 JUL 2020

Removal of temporary tentage outside Screening Centre near ambulance bay.

## 21 MAR 2020

### First COVID-19 fatalities in Singapore

The first COVID-19 fatalities in Singapore were two patients in NCID who passed away from complications due to COVID-19 infection.

## 4 APR 2020

### NCID conducted on-site swabbing operations

During the initial phase of outbreak at the foreign worker dormitory clusters in April 2020, NCID was called upon to carry out on-site swabbing operations at one of the worker dormitories. NCID swiftly put together a team of doctors, nurses and operations staff for this exercise.

## 4 AUG 2020

### Visit by Co-chairs of Multi-Ministry Taskforce on COVID-19

NCID hosted the second visit by Co-chairs of the Multi-Ministry Taskforce on COVID-19, then-Minister for Health, Mr Gan Kim Yong, and then-Minister for Education, Mr Lawrence Wong, and presented updates on COVID-19 research, therapeutics, clinical management, operations and public health approaches. The Co-chairs of the Multi-Ministry Taskforce also met with staff from our outpatient clinic and pharmacy and our medical social workers.



## 7 SEP 2020

### NCID First Anniversary Celebration

NCID celebrated its first anniversary with a virtual event which was graced by Guests-of-Honour, Mr Gan Kim Yong, then-Minister for Health, and Mr Lawrence Wong, then-Minister for Education. Co-chairs of the Multi-Ministry Taskforce on COVID-19. The event was also attended by collaborators and partners from the public healthcare system, academic and research institutions and NCID staff. Associate Professor Kenneth Mak, Director of Medical Services, MOH, symbolically placed a COVID-19 "brick" in NCID's time capsule – containing items that represented NCID's efforts at the forefront of Singapore's COVID-19 outbreak efforts.



## 8 SEP 2020

### Formation of Paeds ICU-ID Sub-committee under National ICU Committee

The Paediatrics ICU-ID subcommittee was set up by MOH under the National ICU Committee to develop a national disease outbreak response with a focus on managing paediatric patients requiring ICU care, building on the work done by the Paediatrics Infectious Diseases (ID) Workgroup for NCID. The committee comprises Paeds ID doctors and Paeds ICU clinicians, and nurse clinicians from KK Women's and Children's Hospital (KKH) and NUH. It is chaired by Associate Professor Thoon Koh Cheng, Head and Senior Consultant of Infectious Disease Service, KKH, and co-chaired by Dr Sapna Sadarangani, Consultant, NCID, and Dr Jacqueline Ong, Head and Senior Consultant, Division of Paediatric Critical Care, Department of Paediatrics, Khoo Teck Puat – National University Children's Medical Institute, NUH.

## 5 OCT 2020

### Revision of Screening Centre operating hours

With the decrease in the number of cases, Screening Centre revised operating hours to 8:30 a.m. to 11:00 p.m. daily, with screening at TTSH Emergency Department (ED) after 11:00 p.m.

## 23 OCT 2020

### Singapore Field Epidemiology Training Programme (S-FETP) Launched

NCID and NUS Saw Swee Hock School of Public Health launched the inaugural six-week Foundational Level Training Course in Applied Epidemiology and Rapid Response. S-FETP is a national public health programme that aims to professionally develop the field investigation skills of local healthcare/public health professionals who are involved in epidemiological work; enhancing the national capacity to swiftly respond to local health threats.



## 18 - 24 NOV 2020

### World Antimicrobial Awareness Week (WAAW) 2020

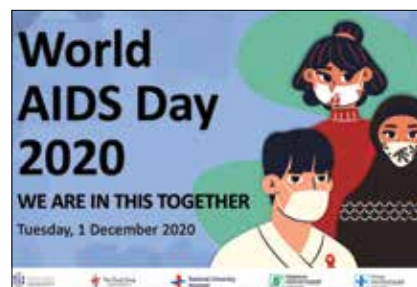
To commemorate World Antimicrobial Awareness Week (WAAW), AMRCO joined public hospitals to organise several initiatives to increase awareness of antimicrobial resistance (AMR) and prevention of the spread of drug-resistant bacteria. AMRCO supported the first WAAW Inter-hospital Webinar Series on AMR co-organised by Khoo Teck Puat Hospital, KKH, NUH, SGH and TTSH. AMRCO also participated in the World Health Organization Regional Office for the Western Pacific's (WPRO) virtual rally, "Stewards for the Future: One Region, One Movement to Fight Antimicrobial Resistance".



## 1 DEC 2020

### World AIDS Day webinar

NCID together with partners held a World AIDS Day webinar for healthcare workers. Themed "We are in this together", it aimed to raise awareness about HIV transmission and challenge misconceptions so as to build empathy and solidarity for PLHIV and healthcare workers. More than 460 participants joined the webinar.



## 1 DEC 2020

### COVID-19 screening operations decentralised

Screening Centre operating hours revised to 8:30 a.m. to 6:00 p.m. on weekdays, excluding public holidays with screening at TTSH ED after 6:00 pm.

## 7 DEC 2020

### Transition of COVID-19 screening operations

With further decrease in the number of cases, COVID-19 screening merged with NCID outpatient Clinic's services.

## 30 DEC 2020

### Roll out of Singapore's COVID-19 vaccination exercise

40 NCID staff were the first in Singapore to receive the COVID-19 vaccine. Senior Staff Nurse Sarah Lim was the first Singaporean to be vaccinated.







## PATIENT CARE

The field of Infectious Diseases is complex. The treatment of and care for patients with infectious diseases require a multidisciplinary team working together to provide centralised clinical management during outbreaks. NCID's integrated functions from clinical care, public health, and diagnostics to research were involved in the response to COVID-19, enabling the centre to respond swiftly to the evolving situation.

On the patient care front, NCID's multidisciplinary teams have the capacity to deliver a wide range of inpatient and outpatient services including Human Immunodeficiency Virus (HIV) disease management, pharmacist-led HIV Drug Adherence Clinic and medication delivery service, managing patients infected by High Level Isolation Pathogens such as Ebola, outpatient/home antibiotic therapy, antimicrobial stewardship and managing Intensive Care Unit (ICU) infections. The adoption of biosafety and infection control best practices including the use of Personal Protective Equipment (PPE) enables the teams to care for patients safely and prevent exposure to other people in the facility and the environment.

The nation's strongest defence against infectious diseases is the capacity of its public health system and institutions to detect and promptly control infectious disease outbreaks. NCID is a purpose-built, patient-centric facility, designed to provide effective disease management and first-rate patient care through a seamless journey from diagnosis to treatment for our patients.

### SCREENING OPERATIONS

During the COVID-19 pandemic, suspect cases were screened at the Screening Centre. Protocols, instructions for COVID-19 screening and infection controls, and safe distancing measures were set up to ensure that healthcare workers and patients were safe, waiting times minimised and the needs of patients met. Despite the long working hours under trying circumstances, the safety and well-being of patients were always the top priority for these staff who carried out their tasks with utmost professionalism, commitment, care and compassion.

When the COVID-19 cases spiked, the Screening Centre was expanded with additional tentage set up in the adjoining outdoor area in March 2020. It was subsequently modified and another tentage near the Ambulance Bay was set up in April to further expand its capacity to accommodate more people.

As the number of COVID-19 cases declined, COVID-19 screening was integrated with NCID outpatient Clinic J's services in December 2020 for integrated, sustained and capacity-based COVID-19 screening.

### OUTPATIENT SERVICES

Outpatient clinical services provided at Clinic J is an integral part of NCID's clinical services. Clinic J provides one-stop holistic, integrated and multidisciplinary services including medical consultations, Pharmacy, Care and Counselling, and Diagnostic Radiology.

At the start of January 2020, Clinic J maintained full volume of business-as-usual (BAU) specialist infectious diseases (ID) services while managing the added workload of reviewing suspect COVID-19 patients discharged and referred from Tan Tock Seng Hospital's (TTSH) Emergency Department and NCID Wards. After the Screening Centre became operational in late January, Clinic J scaled down its BAU consultation services in anticipation of a surge in COVID-19 cases and retained essential services such as attending to emergency referrals, HIV first visits, infectious exposure management, etc. Clinicians continued to provide consultation, screening and the necessary treatment plans for BAU patients with clinical needs. Patients were also returning for blood tests and



procedural appointments. The scaling down of workflows ensured continuity of patient care during the pandemic.

During the pandemic, Clinic J supported the Ministry of Health (MOH) in other public health functions, for example, swab and serology procedures. Clinic J also served as a site for Convalescent Plasma therapy screening. Amidst the COVID-19 outbreak, Clinic J also managed a concurrent dengue surge between May to October 2020.

As COVID-19 cases gradually declined, Clinic J was able to progressively expand its BAU services from August 2020, with clinicians resuming clinic sessions and providing consultations for patients. To enhance the case-load management efficiency, clinicians also leveraged technology and offered teleconsultation services. Other multispecialty services such as Psychiatry, Dermatology and Ophthalmology were also progressively restored in September 2020.

### INPATIENT MANAGEMENT

NCID was designed with the principle to allow scalability, to be able to ramp up as quickly as possible during an outbreak. NCID's healthcare personnel have been kept ready through training in areas like infection control, PPE and Powered Air-Purifying Respirator, care of patients with higher acuity

needs, and outbreak drills. All these supported with infrastructure capacity, allowed for a rapid scale up and response.

When the number of COVID-19 cases started rising in mid-March 2020, beds in NCID filled up quickly. NCID was able to ramp up bed capacity from 330 beds to 586 beds to accommodate the surge in admission. Each isolation room was fitted with an additional bed, enabling the flexibility to cohort clinically stable, confirmed COVID-19 patients. With the expanded capacity, NCID was able to provide tertiary care to more patients. From end April to early May 2020, NCID had around 500 suspect and confirmed COVID-19 cases in its wards.

The right siting of care is placing the patients in the most appropriate level of care set-up. As part of the nation's comprehensive medical plan and to help the acute public hospitals cope with the surge in the number of confirmed COVID-19 cases, patients who were recovering well and waiting full recovery were sent to Community Care Facilities before being discharged home. This process freed up bed resources for critical and high-risk group cases in NCID. The medical, nursing, pharmacy, infection control,

security and operations teams worked closely with MOH to establish the workflow on decanting and to ensure quality care and infection control at the receiving sites.

In a cross-institutional Extracorporeal Membrane Oxygenation (ECMO) collaboration, ECMO teams from the National Heart Centre Singapore/ Singapore General Hospital (NHCS/ SGH) and National University Hospital (NUH) provided support for ECMO treatment in NCID. In preparation, ECMO drills were conducted in February and March 2020 for the hybrid teams comprising personnel from NHCS, NUH and NCID. There were three COVID-19 patients who received ECMO support in NCID ICU in 2020.

NCID and members from the Paediatrics (Obstetrics/Neonates) Infectious Diseases (ID) Workgroup from KK Women's and Children's Hospital and NUH provided expert guidance for the management of COVID-19 family clusters and obstetric patients. This included recommendations to MOH for national policies for this group of patients given their unique needs and considerations during the hospital stay and quarantine. The Paediatrics

ID Workgroup also continued other outbreak preparedness activities and staff training as best feasible in 2020.

The various family groups in NCID displayed resourcefulness in overcoming language barriers when communicating with non-local patients who are unable to understand, read or speak English. One example is where the medical and nursing teams provided patient admission packages and advisories in patient's mother tongue such as Bengali, Tamil and Chinese. The outbreak medical teams comprising both NCID and TTSH-based doctors also produced a video to address frequently asked questions, while the team of medical social workers (MSWs) worked with one of the non-governmental organisations to deploy COVID-19 educational videos in different languages which were played on the television in the patient's room or on personal mobile devices.

## PHARMACY

NCID Pharmacy provides support to both inpatient and outpatient operations as well as NCID Screening Centre and contributes towards NCID's preparedness for outbreaks by ensuring the continuous supply of medicines, novel drugs, re-purposed medications, and vaccinations, and working with various family groups to establish therapy guidelines and education.

NCID Outpatient Pharmacy takes charge of medication supply for outpatient visits and medication delivery to patients of the outpatient clinic. It also runs the outpatient pharmacist-led Drug Adherence Clinic for HIV patients and Directly Observed Therapy (DOT) for HIV patients who have issues adhering to their medications. NCID Inpatient Pharmacy oversees inpatient medication supply, medication reconciliation for all new admissions, as well as provides bedside discharge and specialised counselling to patients in the wards.





## PATIENT CARE



During the pandemic, NCID Pharmacy supported the operation of two pharmacies at NCID Screening Centre in addition to the BAU services. NCID Pharmacy continues to seek improvement in patient care and is the first hospital utilising smart shelves light for picking and packing of medications. This aims to improve medication safety to the patients.

### CARE AND COUNSELLING

The team of MSWs at the Care and Counselling Department at NCID attend to patients and families who are facing emotional, psychological, social, environmental and practical problems arising from their illness or medical condition. The Care and Counselling Department works closely

with the multidisciplinary team to assist patients and their families on their journey towards recovery and healing as an extension of outpatient and inpatient care.

During the pandemic, the MSWs also provided much needed psychosocial support to COVID-19 inpatients of NCID and their families. This was particularly important for ICU patients and their next-of-kin (NOK). Despite the lack of physical interaction, MSWs communicated with patients, and NOK through phone intercom and provided them with much needed comfort and emotional relief. When needed, MSWs would also put on PPE and provide direct intervention in cases where patients require additional emotional support or help in arranging for video calls with their loved ones.



### CLINICAL THERAPEUTICS FOR COVID-19 PATIENTS

A significant number of patients who tested positive for COVID-19, experienced mild symptoms and were able to recover with supportive care. For patients with more serious illness, they were treated with specific therapies such as antivirals or immunomodulatory medications. The COVID-19 Therapeutic Workgroup led by NCID evaluated

and recommended the use of existing (repurposed drugs) and novel therapeutics to treat patients with COVID-19 infection. These included antivirals, immunomodulators, humoral therapies such as convalescent plasma and biologics, and vaccines. The multidisciplinary Workgroup, comprising clinicians from different hospitals, reviewed available evidence as it emerged from trials conducted both locally and globally and made recommendations for COVID-19 therapy. These recommendations were constantly updated as new evidence emerged.

NCID contributed to international multicentre trials using remdesivir, one of the most promising drugs against COVID-19. These local efforts were led by NCID's Infectious Disease Research and Training Office in collaboration with multiple partners including the US National Institutes of Health.

NCID, together with TTSH Haematology, Health Sciences Authority and Duke-NUS Medical School, also started a national convalescent plasma programme for the treatment of patients with COVID-19. Blood plasma treatment is based on the principle that recovered patients have protective antibodies that may help protect them against infection. Preliminary reports indicated that convalescent plasma therapy may have a role in the treatment of patients with severe COVID-19, and could be considered when patients are not eligible for other treatments. Patients who recovered from COVID-19 were invited to be plasma donors. They had to undergo stringent checks to ensure donated plasma was safe and carried sufficient quantities of COVID-19 antibodies. The efficacy of convalescent plasma treatment for COVID-19 is being monitored and is anticipated to contribute to the knowledge on therapy for patients.



Our public health system is the first line of defence against any infectious disease outbreak. NCID's public health units conduct surveillance and epidemiological investigations into diseases of public health importance, support outbreak investigations through specialised laboratory tests, coordinate the national response to antimicrobial resistance across sectors and drive national initiatives for Human Immunodeficiency Virus (HIV) and Tuberculosis.

## ANTIMICROBIAL RESISTANCE COORDINATING OFFICE

Antimicrobial resistance (AMR) is an increasingly serious threat to global public health. The Antimicrobial Resistance Coordinating Office (AMRCO) oversees the implementation, monitoring and evaluation of the National Strategic Action Plan (NSAP) on AMR with a focus on education and training, surveillance and risk assessment, and research. The NSAP was formulated in November 2017 by the former Agri-Food & Veterinary Authority of Singapore (AVA), National Environment Agency (NEA), PUB, Singapore's National Water Agency (PUB), and Ministry of Health (MOH) to set the framework for a national response to AMR. It provides the

roadmap on existing gaps and priorities for future intervention. As part of its supporting efforts, AMRCO developed the NSAP monitoring and evaluation framework with indicators aligned to the Global Action Plan on AMR. In August 2020, AMRCO completed the development of the combined One Health AMR Work Plan for the implementation, monitoring and evaluating the NSAP on AMR.

As a key initiative under the NSAP to unify the reporting of surveillance activities across various agencies, AMRCO published the first Joint One Health Report on Antimicrobial Utilisation and Resistance in Singapore on 29 July 2020. This is Singapore's first multisectoral surveillance activities conducted

in the human, animal, food and water environment sectors and it represents an important first step towards an integrated surveillance system for antimicrobial resistance and utilisation in Singapore.

AMRCO works with partners to facilitate regional and international collaborations, develop regional capacity-building and share expertise with partners in this field. AMRCO represents Singapore in important international platforms with the appointment of Dr Lee Tau Hong, Head, AMRCO as the National Focal Point and Ms Lin Yueh Nuo, Deputy Director, AMRCO as the National Focal Point (alternate) to both the World Health Organization (WHO) Global Antimicrobial Resistance Surveillance System (GLASS) and the WHO Western Pacific Regional



One of the children booths at the World Antibiotic Awareness Week (WAAW) Library Event in November 2019, where children could view bacteria under a microscope

Antimicrobial Consumption Surveillance System (WPRACSS) in 2019.

GLASS aims to enable standardised, comparable and validated data on AMR to be collected, analysed and shared with countries, in order to inform decision-making, drive local, national and regional action and provide the evidence base for action and advocacy. In 2020, Singapore participated in GLASS's first data call and AMRCCO, as the National Focal Point, contributed AMR data with guidance from the National Antimicrobial Resistance Expert Panel (NAREP). WPRACSS aims to set up and build capacity for antimicrobial consumption monitoring and to establish a web-based regional database.

## Education and Training

The World Antimicrobial Awareness Week (WAAW), held annually from 18 to 24 November aims to increase awareness of AMR and encourage best practices to reduce the further emergence and spread of drug-resistant bacteria. In support of WAAW, AMRCCO works closely with key stakeholders to hold community outreach events and webinars for healthcare professionals, to produce education toolkits for primary care



A social media campaign post for World Antimicrobial Awareness Week (WAAW) 2020

physicians and content for social media campaigns, and to publish opinion pieces by experts.

## Surveillance and Risk Assessment

In December 2018, AMRCCO initiated an Antimicrobial Utilisation (AMU) surveillance pilot in all polyclinics and followed on with an AMR polyclinic surveillance pilot in November 2019. AMRCCO also initiated discussions with the National General Practitioner (GP) Advisory Panel to conduct an AMU surveillance pilot in GP clinics and chains in April 2020. The implementation of AMR and AMU surveillance in the public primary care sector is an important initiative from the NSAP on AMR. The collection of surveillance data facilitates the monitoring and trending of antibiotic usage and resistance data in primary care and serves to inform overall national policies on AMR. In addition, the data provides a useful baseline for the assessment and measurement of outcomes for interventions, such as educational campaigns to address the inappropriate use of antibiotics.

AMRCCO works closely with the One Health agencies to facilitate and coordinate AMR efforts across human, environmental, food and animal sectors. Additionally, AMRCCO provides secretariat support to the National Antimicrobial Resistance Control Committee (NARCC) and its expert panels, National Antimicrobial Stewardship Expert Panel (NASEP) and NAREP, and the One Health Antimicrobial Resistance Work Group.

Since 2019, AMRCCO has been publishing the annual NARCC Report for Public Hospitals in Singapore. It released the first NARCC Report for Private Hospitals in Singapore on 21 December 2020. The NARCC reports

aim to monitor antimicrobial usage as well as antimicrobial resistance in bacterial and fungal infections affecting hospitalised patients. The reports also serve to facilitate each institution's internal benchmarking and comparison, and guide measures for improving AMU and AMR in Singapore.



Publication of Annual National Antimicrobial Resistance Control Committee (NARCC) Reports for Public and Private Hospitals in Singapore

## Research

NCID's role as a research coordination office is to launch and administer grant calls with the aim to steer the national One Health AMR research agenda and commission multidisciplinary and multisectoral studies with results that can be translated into practice. AMRCCO secured research funding for One Health AMR research from FY2021 to FY2025 from MOH, NEA, National Parks Board/Animal and Veterinary Service (NParks/AVS), PUB, and Singapore Food Agency (SFA) to support AMR research across the human, animal, food and environment sectors in Singapore. Following which, NCID was appointed as Grant Intermediary for the One Health Antimicrobial Resistance Research Programme (OHARP) on 29 December 2020 to fund research in three key priority areas, namely transmission pathways, socioeconomic impact, and knowledge, attitudes and practices.

## NATIONAL PUBLIC HEALTH AND EPIDEMIOLOGY UNIT

The National Public Health and Epidemiology Unit (NPHEU) supports national efforts in infectious disease prevention, surveillance, response and preparedness to protect Singapore against communicable diseases and antimicrobial resistance, thereby strengthening the linkage between expertise in public health, epidemiology and policy development.

NPHEU monitors, identifies and tracks trends in local infectious diseases including Human Immunodeficiency Virus (HIV), Tuberculosis (TB) and other infectious diseases of public health importance in Singapore. It does this through disease registries, surveillance programmes and collaboration in epidemiology studies, providing an evidence base for the National HIV and TB Programmes.

NPHEU provides long-term horizon scanning and risk assessment of infectious disease threats for clinical and public health practice guidance. Through systematic review of international literature, NPHEU harnesses the best available evidence to inform clinical and public health practices in infectious disease control

and prevention. On the operational side, NPHEU's HIV Team and TB Enforcement Team contribute towards the national responses to HIV and TB. Its Epidemiology and Analytics Team works closely with national and international partners to provide public health and epidemiological insights to support Singapore's preparation, prevention and response to infectious diseases.

### NPHEU played an important role in Singapore's response to the COVID-19 outbreak

One of the roles of NPHEU is to perform horizon scanning for emerging infectious diseases. In early January 2020, the unit noticed reports of atypical pneumonia clusters in Wuhan, China. NPHEU started horizon scanning and surveillance through daily tracking of reports from China and other countries, particularly those with high numbers of cases or deaths, and from the World Health Organization (WHO).

As part of Singapore's COVID-19 response strategy, NPHEU collated the number of positive cases from laboratory testing and other data on cases from multiple sources, analysed and organised the clinical data on positive cases for daily updates to the

Ministry of Health (MOH). In addition, NPHEU supported the efforts of the MOH Epidemiology Team by studying the epidemiological data of the positive cases admitted to NCID to search for and identify links among the cases. Through these, the associations within several local clusters were identified and links to imported cases were eventually found.

Data analysis performed by NPHEU helped to identify high-risk sub-populations needing special care. From the clinical profile of COVID-19 cases, NPHEU was able to ascertain that the proportion of cases needing oxygen and ICU care increased exponentially with age, particularly 50 years old and above. This finding guided NCID to project ICU capacity and prepare bed complements to meet increasing demand at the peak of the outbreak. Clinical protocols were established to stratify patients to appropriate levels of clinical care after the findings were presented to MOH.

### Report on Assessment of Environmental Transmission and Mitigation

NPHEU, together with MOH and National University of Singapore Saw Swee Hock School of Public Health, contributed to a COVID-19 Science Report on the assessment of environmental transmission and mitigation.

Existing studies showed that the vast majority of SARS-CoV-2 transmission clusters were associated with indoor or indoor-related (mixture of indoor and outdoor spaces) settings. This report explores the risk of environmental transmission of COVID-19 in vocalisation activities, taxis and private hire cars, and restaurants, and summarises features of fomite-mediated and airborne transmission through the review of available reports and literature.





## NATIONAL PUBLIC HEALTH LABORATORY

The National Public Health Laboratory (NPHL) was set up in 2007 under the Communicable Diseases Division, Ministry of Health (MOH), Singapore. With the formation of NCID, NPHL is now one of NCID's public health units located at Level 13. NPHL's facilities include both a biosafety-level 2 (BSL2) laboratory and a BSL3 high containment facility.

### Our People

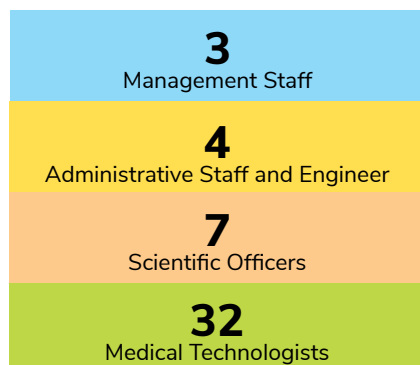
Our scientific officers and medical technologists are supported by administrative staff and an engineer.

### Management Team

- Associate Professor Raymond Lin Tzer Pin, FRCPA, MBBS  
Director
- Cui Lin, PhD  
Senior Principal Scientific Officer
- Roger Chua Peng Jin  
Laboratory Manager

### Scientific Officers

- Carmen Low, PhD  
Senior Scientific Officer, HIV
- Jean-Marc Chavatte, PhD  
Senior Scientific Officer, Parasitology
- Michelle Ang Lay Teng, PhD  
Scientific Officer, Bacteriology and TB
- Alicia Lim Jieling, PhD  
Scientific Officer, Bacteriology and TB
- Mak Tze Minn, PhD  
Scientific Officer, Virology
- Grace Ngan Jie Yin, PhD  
Scientific Officer, Virology
- Ng Yi Kai, PhD  
Scientific Officer, Virology and Electron Microscopy



## Achievements by NPHL

### Samples or Isolates received by NPHL for the past 5 years

**BACTERIOLOGY**  
1,200 to 1,700 samples were received annually

**PARASITOLOGY**  
45 to 55 samples were received annually

Conducted Malaria proficiency test programme twice a year for 30 to 40 participating laboratories

**VIROLOGY**  
9,100 to 15,100 samples were received annually

### Investigations conducted by MOH in the past 5 years

**ACUTE RESPIRATORY INFECTION CLUSTERS**  
101

**GASTROINTESTINAL CLUSTERS**  
201

### Main Functions of NPHL

1. Conducting laboratory-based surveillance to monitor changes in the occurrence and nature of pathogens.
2. Responding to outbreaks by timely detection of causative pathogens and supporting epidemiological investigations.
3. Detecting novel, rare, exotic or dangerous pathogens including biothreat agents.
4. Supporting national programmes for Human Immunodeficiency Virus (HIV) and Tuberculosis (TB).

### Technologies used in NPHL

#### Identification and typing of bacteria

Agar and broth culture in the combination with MALDI-ToF, antimicrobial susceptibility testing, serotyping, PCR, Multi-Locus VNTR Analysis (MLVA), Multi-Locus Sequence Typing (MLST) and Whole Genome Sequencing (WGS)

#### Detection and identification of viruses

PCR, Multiplex PCR panels, Sequencing, Genotyping, Whole Genome Sequencing (WGS) and virus isolation (BSL2)

#### Serology

Immunofluorescence (IF), Enzyme immunoassay (EIA) and Chemiluminescence assay (CLIA)

#### Other techniques

Transmission Electron Microscopy (TEM) and virus isolation in BSL3 high containment facility

### Accreditation

NPHL is accredited by the Singapore Accreditation Council (SAC) under the Singapore Laboratory Accreditation Scheme (SINGLAS) to international standard ISO15189:2012.

### Core Programmes in NPHL

#### Bacteriology

Examples: *Salmonella* species, *Staphylococcus aureus*, *Streptococcus pneumoniae*, *Clostridium difficile* and antibiotic-resistant bacteria, *Mycobacterium tuberculosis*, *Bordetella pertussis*, *Enterohemorrhagic Escherichia coli*, *V. cholerae*, Mycology

#### Parasitology

Malaria - morphology, PCR, sequencing  
Microsporidia, others

#### Virology

Examples: Respiratory virus, Arboviruses, Enteroviruses, Norovirus, Rotavirus, Measles and Rubella, HIV

#### Others

High risk and exotic pathogens such as SARS, MERS-CoV, H5N1, H7N9, West Nile Virus, Ebola Virus  
National Seroprevalence Survey

## NPHL Global, Regional and Local Engagement

### RPHL

NPHL is a member of the Regional Public Health Laboratory (RPHL) network established under the Global Health Security Agenda (GHSA) initiative. The RPHL network aims to provide support in strengthening national laboratory systems for timely detection of pathogens with outbreak potential.

### IHR JEE Mission in Philippines

Dr Cui Lin participated as a technical expert for the International Health Regulation, IHR (2005) Joint External Evaluation (JEE) for the Philippines. JEE is a voluntary process in which a team of national and international experts jointly assess a country's capacity under the IHR to prevent, detect, and rapidly respond to all acute public health events and emergencies. JEE is also an important element of monitoring and evaluation under the Asia Pacific Strategy for Emerging Diseases and Public Health Emergencies (APSED III).

### WHO PIP Framework

Associate Professor Raymond Lin is appointed the Chairperson for 2021 to the Pandemic Influenza Preparedness (PIP) Framework Advisory Group which comprises 18 experts who monitor the implementation of PIP Framework and provide advice to World Health Organization (WHO) Director-General. He has been a member of the PIP Framework Advisory Group since 2016.

### WHO SARS-CoV-2 Reference Laboratory

NPHL is designated as a reference laboratory in the WHO COVID-19 Reference Laboratory Network, providing COVID-19 technical advice, and diagnostic and confirmatory testing.

### WHO National Influenza Centre

NPHL is the National Influenza Centre (NIC) for Singapore, designated by WHO as part of the Global Influenza Surveillance and Response System to conduct seasonal influenza surveillance and support WHO recommendations on annual vaccine composition.

### WHO National Measles and Rubella Reference Laboratory

NPHL is appointed as the National Measles and Rubella Reference Laboratory for Singapore under the WHO Western Pacific Region (WPR) Measles Elimination Programme and is responsible for the testing and typing of measles and rubella samples for public health surveillance according to WHO's recommendations.

### Malaria Reference Centre (MRC)

NPHL is the Malaria Reference Centre in Singapore and conducts both surveillance and malaria proficiency testing, which is part of the requirement of PHMC licensing for clinical laboratories that provide malaria test.

## NPHL responded to global, regional and local public health events





## NATIONAL HIV PROGRAMME

Human Immunodeficiency Virus (HIV) remains a public health priority in Singapore. In order to coordinate a national concerted response to the ongoing epidemic, the National HIV Programme (NHIVP) aims to formulate a coherent national plan to achieve the UNAIDS 90-90-90 targets and beyond.

The NHIVP works to effect HIV programmes and policies to end HIV in Singapore, and to advocate for and formulate policies that reduce stigma and discrimination experienced by people living with HIV (PLHIV). The Programme coordinates the formulation and recommendation of evidence-based guidelines on HIV testing, treatment including anti-retroviral therapy (ART) and patient management. This includes providing clarification on the national position on interventions such as Pre-Exposure Prophylaxis or PrEP and HIV self-testing. NCID works with clinicians, healthcare professionals, public health practitioners, academics and other stakeholders to deliver quality and holistic patient-centred, cost-effective and evidence-based care for PLHIV, consistent with standards and recommendations by a shared community of care providers comprising multidisciplinary professionals and stakeholders. The NHIVP also works closely with the public health units including National Public Health and Epidemiology Unit and National Public Health Laboratory to achieve better surveillance and control of HIV infections.

In order to adopt a holistic approach to delivering HIV care, NHIVP takes the lead in establishing national guidelines and recommendations for treatment and care of PLHIV. In 2020, NHIVP released the Recommendations for the Use of Antiretroviral Therapy (ART) in Adults Living with HIV in Singapore, and Guidance for the Prescription of HIV Pre-Exposure Prophylaxis (PrEP) in Singapore. NHIVP has also prepared



World AIDS Day 2020

a position paper on “Establishing Continuum of Existing Services” which details current state of continuum of care – services offered, resources, gaps and needs. In addition, the NHIVP was involved in the work spearheaded by Agency for Care Effectiveness (ACE) that resulted in the addition of ART on the Standard Drugs List, which made HIV treatment much more accessible and affordable for PLHIV in Singapore.

The NHIVP plays a central role in enhancing education and training related to HIV in Singapore. This includes the training of healthcare professionals in HIV-related skills and knowledge, such as collaborative prescribing for and care of PLHIV, and the provision of right-sited primary and chronic care, as well as increasing awareness and reducing HIV-related stigma and discrimination in the general population. In December 2020, NHIVP held its first PrEP Prescriber Course where local experts in the field shared best practices in prescribing HIV PrEP, which is a highly effective way of reducing the risk of contracting HIV infection. Close to 220 participants attended the webinar on 12 December

2020. The NHIVP will also provide assistance in public and inter-professional communications as and when required.

The NHIVP adopts a multifaceted approach to achieving its objectives. This includes raising awareness, enhancing community outreach and setting treatment guidelines. NHIVP’s awareness programmes include campaigns across various media platforms and opinion pieces by experts to educate the public about HIV and to reduce stigma against PLHIV and their families. One such initiative fronted by NHIVP included the HIV Destigmatisation Campaign in December 2019 which aimed to increase the knowledge and decrease misconception on spread of HIV, increase acceptance of PLHIV in workplaces, and to increase HIV testing while reducing stigma on HIV testing. As part of this campaign, two videos were produced to dispel misinformation about how HIV spreads to eradicate stigma, so those at-risk can get tested and seek treatment early. These videos were also featured as part of NHIVP’s World AIDS Day 2020 event.



## NATIONAL TUBERCULOSIS PROGRAMME

The National Tuberculosis (TB) Programme was strengthened with the launch of the Singapore TB Elimination Programme (STEP) by the Ministry of Health in 1997. STEP aimed to strengthen national TB control efforts with the goal to detect and treat all infected contacts, and to prevent the emergence of multidrug resistant TB. The STEP Registry and the Tuberculosis Control Unit (TBCU) fall under the ambit of the National TB Programme.

The STEP Registry administers the national TB registry which oversees notification of all TB cases and monitors the treatment progress and outcome of all TB cases in the country.

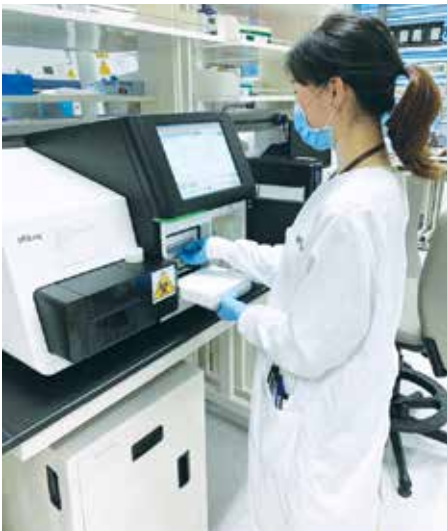
TBCU functions as the national referral centre for TB evaluation and treatment, and the management of complicated or drug-resistant TB patients. It manages 80% of the country's TB cases; the vast majority of which are treated under Directly Observed Therapy (DOT). Since 2012, TBCU has been providing

Outreach DOT (ODOT) to patients who have mobility problems and are unable to visit TBCU or a polyclinic for DOT. The number of patients on ODOT has increased from 41 cases in 2019 to 80 cases in 2020. TBCU started video-observed therapy in 2018 with only 10 patients and this has increased to about 90 patients in 2020. There are plans to further expand the programme.

For effective tracing of TB transmission in an outbreak, whole genome sequencing (WGS) for all TB positive cultures was carried out in collaboration with the National Public Health Laboratory since November 2020 to boost public health surveillance. Prior to this, WGS was done for selected isolates as part of a molecular typing programme.

Another major function of the National TB Programme is the screening of close contacts in households, workplaces and congregate settings (such as schools and prisons) for active and latent TB, and provision of preventive therapy for contacts found to have latent TB infection.

To facilitate site assessment for TB contact tracing during the COVID-19 pandemic period, virtual site assessment (VSA) was implemented to increase productivity. About 70 VSA were conducted between April 2020 and December 2020. These resulted in shortened lead time to visit from five days to two days, decreased site assessment time from four hours to 45 minutes which led to better efficiency, and increased safety for staff during the pandemic.



Universal whole genome sequencing by the National Public Health Laboratory



Virtual site assessment



Tuberculosis Control Unit



# RESEARCH, TRAINING AND EDUCATION

To strengthen the national preparedness and defence against the threat of emerging infections, the Infectious Disease Research and Training Office (IDRTO) conducts and coordinates collaborative research efforts, and training and education on infectious diseases. The IDRTO consists of three component offices – National Infectious Disease Research Coordinating Office, NCID Research Office, and Training and Education Office.

## NATIONAL INFECTIOUS DISEASE RESEARCH COORDINATING OFFICE

The National Infectious Disease Research Coordinating Office (NIDRCO) facilitates collaborative infectious disease research between healthcare and research institutions in Singapore and beyond. NIDRCO also develops human capital for infectious disease research including seed funding and travel fellowships. It reviews the strategy and direction of the research on infectious diseases in Singapore and coordinates national pandemic and epidemic preparedness.

### Mapping Singapore's Research Landscape

The NIDRCO collaborated with the National University of Singapore (NUS) Library Digital Scholarship team to launch the Singapore Infectious Diseases Research Landscape Mapping website on 7 September 2020. The website facilitates sharing of information on infectious disease research and clinical capabilities in an interactive and visual way as well as fosters closer collaboration among researchers and clinician scientists. The mapping of Singapore's infectious disease research landscape enables NIDRCO to attract more research funding, enhance collaboration for research excellence and showcase Singapore's research capabilities to the world.

### Supporting National COVID-19 Research Efforts

The NIDRCO played a critical role in strategising, coordinating and supporting national COVID-19 research efforts. The Pandemic Preparedness and Research Coordinating Office (PPRCO) under NIDRCO provided support to the



Collection of blood samples from a recovered patient for PROTECT study

National COVID-19 Research Workgroup which was formed in January 2020 to produce studies to understand COVID-19 transmission in Singapore. The Workgroup is chaired by NCID Executive Director, Professor Leo Yee Sin and advised by Ministry of Health (MOH) Chief Health Scientist Professor Tan Chorh Chuan and brought together researchers, clinicians and representatives from NCID, Agency for Science, Technology and Research (A\*STAR), NUS, Duke-NUS Medical School, MOH, National Research Foundation (NRF), National University Hospital (NUH), Nanyang Technological University, National Medical Research Council (NMRC), DSO National Laboratories, Singapore Clinical Research Institute, and National Healthcare Group (NHG). The research efforts commissioned by this Workgroup contributed immensely to Singapore's success in managing and controlling the pandemic.

The Singapore Infectious Disease Clinical Research Network (SCRN), a unit under NIDRCO, coordinates multicentre infectious disease clinical studies and provides support to boost capacity for research in the event of an outbreak. It is overseen by an executive committee with representatives from every public hospital and this extensive hospital network was critical in activating a clinical research response plan and for collection of biological specimens for COVID-19 outbreak research.

One of the SCRNs initiatives is PROTECT, a multicentred prospective study to detect novel pathogens and characterise emerging infections. This protocol, covering all public hospitals in Singapore, has enabled the collection of information and biological samples for research purposes. The first PROTECT patient was recruited on 24 January 2020, one





day after Singapore reported its first confirmed COVID-19 case, illustrating NCID's high state of preparedness to promptly respond to an outbreak. As of 31 December 2020, more than 600 patients were recruited for COVID-19 study.

Over the last seven years, SCRNL has conducted more than 20 multicentre clinical projects and established partnerships with international institutions from Australia, the United States, Thailand and Malaysia.

### NCID RESEARCH OFFICE

The NCID Research Office oversees research as well as the maintenance of NCID research facilities which includes the Infectious Disease Research Laboratory (IDRL) and NCID Research Clinic.

IDRL provides intellectual and infrastructural support for clinician researchers and scientists to conduct their infectious disease laboratory-based research. IDRL integrates research activities in the area of

infectious diseases while providing a platform for collaborations and interactions between clinician researchers and scientists, and provide avenues for multidisciplinary activities. IDRL also houses the National Infectious Diseases Biorepository (NIDB), which serves as a national resource for the systematic preservation of microbial specimens and associated materials to support public health efforts, preparedness research and training.

IDRL encourages the translation and application of research findings to patient care and to inform public health efforts, and serves as a core facility and resource for research for the infectious disease community. Studies that IDRL focused on include research on multidrug resistant bacteria, including rapid detection, environmental surveillance, genomics and infection control related studies; arboviruses (e.g. dengue, Zika virus) and immune responses; Human Immunodeficiency Virus (HIV) epidemiology; influenza and other respiratory viruses including COVID-19.

The NCID Research Clinic supports investigator-initiated and industry-sponsored studies from NCID, other institutions within NHG, and the wider infectious disease community in Singapore. The NCID Research Clinic is the site for long-term follow-up of COVID-19 research subjects recruited under PROTECT.

The P. H. Feng Research Centre (PHFRC) under Tan Tock Seng Hospital, is intended to support researchers with clinical trials of new medications where study participants may need to stay after office hours or overnight for trial procedures. Located at level two of NCID, the mission of PHFRC is to provide facility and trial management support to researchers within NCID and NHG. More than 30 trials have been conducted at PHFRC which include phase one study of COVID-19 monoclonal antibody developed by DSO National Laboratories, phase two study of Duke NUS-Arcturus COVID-19 vaccine, hemato-oncology trials, dermatology trials as well as trials for treating renal diseases.



Infectious Disease Research Laboratory



NCID Research Clinic

\* Photo was taken in 2019 before COVID-19



# RESEARCH, TRAINING AND EDUCATION

## TRAINING AND EDUCATION OFFICE

The Training and Education Office (T&E) caters to the infectious disease training and professional development needs of individual healthcare workers, and building the professional capabilities of the regional health systems in Singapore, the community, and intermediate and long-term care providers in Singapore's healthcare ecosystem.

T&E focuses on public education via community partnerships and engagement to prevent the spread of infectious diseases and build community preparedness for outbreaks. Over the years, T&E has conducted regular public education programmes aimed at increasing awareness, knowledge and reducing stigma and discrimination about HIV and people living with HIV, improving the adoption rate of recommended vaccinations for adults, reducing antibiotic overuse and antimicrobial resistance, and preventing vector-borne infections such as dengue.

During the pandemic, T&E also worked with partners in the community to conduct public education programmes aimed at enhancing community

preparedness against disease outbreaks and educating the public on measures to protect themselves from COVID-19, as well as the benefits of influenza and pneumococcal vaccination. These talks were highly relevant for the target audiences during COVID-19.

Through its community outreach efforts, T&E engaged approximately 2,700 members of the public in 2020.

## SIGNIFICANT CONTRIBUTIONS TO COVID-19 RESEARCH

In 2020, NCID led or co-authored 97 peer-reviewed research papers on COVID-19 published in scientific publications. 15 were featured in top journals such as *New England Journal of Medicine*, *Journal of the American Medical Association*, *Lancet*, *Nature* and *Science*.

NCID has, either on its own or in collaboration with other institutions, been involved in several research efforts on COVID-19 aimed at better understanding the disease pathogenesis and transmission, development of serology testing platforms, modelling of disease spread, and socio-behavioural aspects of the impact of COVID-19

on the population. NCID adopts a multicentre, multiprong and multiplatform approach to leverage the resources, domain knowledge and expertise in the healthcare ecosystem to optimise its research capacity and efficiency.

We would like to thank ams Sensors Singapore, Diasham Resources, Saxo Markets Singapore, Sumitomo Mitsui Banking Corporation, The Estate of Irene Tan Liang Kheng, and Wells Fargo Bank NA that have contributed and supported research in infectious diseases through the NHG Fund and TTSH Community Fund.

## National COVID-19 Research Workgroup

NCID responded swiftly to the COVID-19 outbreak with the formation of the National COVID-19 Research Workgroup (RWG) on 22 January 2020, just one day before Singapore reported the first confirmed COVID-19 case. The RWG, which is chaired by NCID Executive Director, Professor Leo Yee Sin, has been meeting regularly to discuss the latest developments and channel research efforts towards priority areas.

The research work by RWG received the NHG Research Impact Award under the NHG Research and Innovation Awards (NRIA) 2020. The NRIA 2020 aims to recognise individuals and teams who have made outstanding contributions to improve health outcomes or delivery, as well as promote the spirit for continuous research and innovation in NHG. The team, led by Associate Professor David Lye, Director, IDRTO, NCID with team members – Dr Barnaby Edward Young, Head, Singapore Infectious Disease Clinical Research Network, IDRTO, and Consultant, NCID; Professor Wang Linfa from Duke-NUS Medical School; and Professor Lisa Ng from A\*STAR was selected as one of the winners among the 23 nominations which NRIA 2020 received.



T&E supported the Antimicrobial Resistance Coordinating Office in the Community Health Talks by infectious diseases specialists who debunked myths about vaccinations and gave practical tips on preventing and treating cough and colds at the World Antibiotic Awareness Week (WAAW) Library Event in November 2019 at Woodlands Regional Library

\* Photo was taken in 2019 before COVID-19



## COVID-19 Research Studies

### Three National-level Seroepidemiological Studies to Determine Level of COVID-19 Infection in Singapore

The RWG had commissioned three seroepidemiological studies to determine the proportion of Singapore's population infected by COVID-19 and to understand how successful the prevention of COVID-19 infections in key groups such as frontline healthcare workers have been.

#### Study on Residual Sera

Conducted by NCID and Duke-NUS Medical School, the study found that COVID-19 exposure in the community is extremely uncommon indicating no widespread community transmission as of the last two weeks of March 2020.

#### Multi-site COVID-19 Seroepidemiology Study of Healthcare Workers

Potential nosocomial transmission and healthcare worker (HCW) infections were a key concern during the COVID-19 pandemic in Singapore. Hence, NCID conducted a sero-epidemiology study amongst HCWs to assess the risk of occult COVID-19 transmission and evaluate the effectiveness of preventive measures.

More than 1,400 HCWs working in COVID-19 and non-COVID-19 areas from NCID, Tan Tock Seng Hospital, other public healthcare institutions, and primary care clinics voluntarily enrolled in the longitudinal study.

Initial serology results at enrolment between February and April 2020 from more than 400 HCWs in TTSH and NCID showed no evidence of SARS-CoV-2 seroconversion.

#### Study of Persons at High Risk of COVID-19 Exposure

Study conducted by NCID involving 7,770 close contacts of COVID-19 patients showed the symptom-based PCR attack rate for household, work

and social contacts was 5.9%, 1.3% and 1.3%. Among close contacts, it was estimated that symptom-based testing missed 62% of diagnoses and 36% of SARS-CoV-2 infected persons were asymptomatic.

The study was published online in *The Lancet Infectious Diseases* in November 2020.

### SOCRATES

SOCRATES (Strengthening Our Community's Resilience Against Threats from Emerging Infections) is NCID's long-term research programme launched in 2019 to study key gaps in pandemic preparedness, planning and response by assessing risk perception and knowledge, communication of risk and the necessity of outbreak interventions among the general population. In January 2020, SOCRATES launched a cohort-based study to assess public perceptions about COVID-19 and their responses to interventions by health authorities. The benefit of the cohort-based study is that it provides real-time updates, as compared to post-outbreak cross-sectional studies. As of 31 December 2020, the study involved more than 1,800 participants who took an online survey every month with the first survey being rolled out at the end of January 2020.

Some of the key findings showed that respondents have high trust in the government's ability to handle COVID-19 and in official government communications. Social media is the dominant source of information and many respondents reported receiving information which may be false from such channels.

#### Study on COVID-19 Environmental Contamination

The study published in *Nature Communications* in May 2020 was conducted by NCID, Duke-NUS Medical School and DSO National Laboratories to determine patterns of environmental contamination and particle size distribution of SARS-CoV-2. Funded by

the NMRC COVID-19 Research Fund and supported by the NRF and MOH, the study yielded important evidence-based information that guided medical interventions in containing the disease. The study showed that contamination of surfaces by SARS-CoV-2 particles peaks in the first week of illness and reduces significantly in the second week suggesting that the possibility of a patient infecting others through contaminated surfaces is negligible from week two of illness. This is one of the first studies in the world where the researchers also detected SARS-CoV-2 in particle sizes of less than 4 microns, contributing to the accumulating evidence supporting aerosol-based transmission of SARS-CoV-2.



Study on COVID-19 Environmental Contamination

### Collaboration in Global Research

NCID has also been at the forefront of global research into novel therapeutic development and participated in multicentre COVID-19 randomised controlled trials including conducting clinical trials to determine the efficacy of remdesivir as a treatment for the disease. NCID also participated in the US National Institutes of Health's (NIH) Adaptive COVID-19 Treatment Trial (ACTT), testing the efficacy of combination of remdesivir with existing drugs like baricitinib, interferon-beta-1a, and dexamethasone which are used to treat other diseases as a treatment for COVID-19 patients. Another NIH-lead clinical trial which NCID participated in is Accelerating COVID-19 Therapeutic Interventions and Vaccines (ACTIV-3) where multiple monoclonal antibodies are investigated as therapeutic agents for COVID-19 treatment.



## OPERATIONS MANAGEMENT



The Operations team works closely and supports all functional units in ensuring the availability of necessary resources and establishing workflows. Through comprehensive planning, development and implementation of key operational strategies, the Operations team delivers quality services to patients, staff and visitors in NCID. The team also manages operating finances, utilisation of facilities, infrastructure, projects, inpatient wards and outpatient clinics.



The Operations team coordinated with the Nursing team to ramp up the bed capacity in NCID by deploying additional beds and equipment to the wards during the peak of the COVID-19 pandemic

The Operations team comprises four operation units – Clinical Operations, Public Health Operations, Emergency Preparedness – Disease Outbreak (EP-DO), and Infrastructure and Facilities Operations.

The Clinical Operations unit works closely with Clinicians, and Nursing and Allied Health teams to deliver high quality patient care services including training and outbreak preparedness.

The functions of the Clinical Operations unit includes reviewing work processes, analysing data and implementing patient-centred improvement initiatives. The Clinical Operations unit works together with other units in NCID to support and manage outbreaks of various scale on-site and off-site including screening operations and ramping up of screening and bed capacity at NCID.

To achieve key public health objectives, the Public Health Operations unit collaborates closely with the Ministry of Health (MOH) and the public health units in NCID. The Public Health Operations unit undertakes the review of work plans, processes and supports initiatives across the public health units including public health programmes for Human Immunodeficiency Virus (HIV) and Tuberculosis. The team also provides support to public





NCID's Operations team prepared and distributed care packs to our Private Transport Operators on 1 May 2020, Labour Day to show our support and appreciation to them for ferrying suspect and confirmed positive COVID-19 patients to the Screening Centre. Mr Albert Tan, Director, Operations is seen here giving out a care pack to one of our transport operators representative



EP-DO unit helps the operations of the NOCC - JCC, ensuring seamless back end support to COVID-19 outbreak response

health units in research, training, community engagement, education and facilitates national level collaborative partnerships.

The EP-DO unit is responsible for developing operational readiness at an institutional level to respond in a timely manner and effectively in the event of an outbreak. The team strategises and develops response plans for various

outbreak scenarios and coordinates with key stakeholders to manage outbreaks of various scale. The EP-DO unit works closely with MOH and respective units in NCID to enhance the national outbreak training and readiness framework.

The Infrastructure and Facilities Operations unit collaborates with various departments providing

facilities services to ensure effective management and maintenance of dedicated facilities in NCID. The unit oversees all infrastructure projects and is responsible for reviewing the use of NCID's facilities and utilities.

**Operations Team's Support in the Battle Against COVID-19**

The Operations team played a critical role in the battle against COVID-19. The team operates and manages the NCID Operations Command Centre – Joint Crisis Call Centre (NOCC - JCC) executing command, control and communication functions with other NCID units, Tan Tock Seng Hospital and partner agencies. In tandem with the evolving COVID-19 ground situation, the Operations team analyses data, reviews and revises response plans and work flows to effectively manage patient workload and capacity.

The team coordinated decanting of patients from NCID to Community Care Facilities, working closely with medical, nursing, pharmacy and support units such as housekeeping, security, and food and beverage on the discharges process for these patients.





# OUTBREAK READINESS/PREPAREDNESS

The COVID-19 pandemic has shown that infectious diseases can emerge anywhere in the world and if not swiftly controlled, can spread very quickly and affect the whole world, devastating lives and economies. Singapore, a global and open city and an international transportation and trade hub, is vulnerable to the importation of infectious diseases. Thus, it is imperative for NCID to maintain a high state of readiness at all times and to stay alert and prepared to respond swiftly and decisively to any disease outbreak. Two key ways of doing so are through the training of healthcare workers and harnessing technology.

## DISEASE OUTBREAK READINESS TRAINING

A structured and continuous training programme is essential to enhance NCID's readiness and preparedness to handle infectious disease outbreaks. To this end, NCID has been carrying out exercise planning, conducting drills and exercises for staff as part of disease outbreak readiness training, and also to build better teamwork. The trainings focus on three outbreak scenarios – respiratory related pathogen (such as a new strain of highly virulent coronavirus), High Level Isolation Pathogen (such as Ebola, Lassa fever), and localised outbreak (such as diphtheria, measles).

NCID adopts a multilevel, structured approach to training. The first is individual training such as Personal Protective Equipment (PPE) training, and task training, where staff acquire and maintain the required skillsets through competency training and drills to competently perform the assigned activities for outbreak management. During the pandemic, NCID conducted Just-in-Time (JIT) training sessions on the use of PPE

and Powered Air-Purifying Respirator (PAPR) for more than 400 medical staff comprising doctors and nurse clinicians from NCID and Tan Tock Seng Hospital (TTSH) who are required to work in Intensive Care Unit (ICU) wards, and Extracorporeal Membrane Oxygenation (ECMO) doctors, nurses and perfusionists from National Heart Centre Singapore/Singapore General Hospital (NHCS/SGH), and National University Hospital (NUH).

The second is subsystem/department level training, where staff are trained to carry out assigned tasks as a team within the department or interfacing tasks across departments to realistically simulate responses and the coordination between teams and departments during an actual operation. One example of a subsystem/department level training that was carried out was a live patient exercise in the High Level Isolation Unit (HLIU) where the response team had to undergo training in multifunctional operations, through the realistic simulation of managing a patient suspected of having an emerging infectious disease (EID).

Our scheduled and planned individual and subsystem training includes the Emerging Virulent Pathogen Readiness and Simulation Training (EVEREST) programme. As part of the national effort to maintain readiness to manage Ebola virus disease (EVD) and other viral haemorrhagic fevers (VHF), NCID conducted training under the EVEREST programme for doctors, nurses, allied health and ancillary staff of NCID, TTSH, KK Women's and Children's Hospital (KKH), and NUH. This periodic training includes updated hospital policies and protocols to manage and care for patients with EVD/VHF and the management of paediatrics, obstetric and neonates with such highly infectious pathogens. The policies and protocols related to outbreak preparedness for paediatric, obstetric and neonate patients is developed by the multidisciplinary cross-institution NCID Paediatrics (Obstetrics/Neonates) Infectious Diseases (ID) Workgroup. This workgroup formed in 2018 also works with the EVEREST programme to identify staff to be trained and develop the training programme for KKH and NUH staff who may be activated. The EVEREST programme is imperative in ensuring Singapore remains vigilant against public health threats both locally and overseas which can potentially cause mass outbreaks and lead to high mortality among the affected persons.

Another example of individual and subsystem level training is where NCID conducted exercises to simulate activation of ramp up capacity to manage surge in patients infected by a respiratory related pathogen, by physically opening up a 'mothball' ward including preparations for receiving patients within short notice.



PPE and PAPR Training on 5 February 2020





PMIU Exercise on 28 February 2019

The third is at a system level where NCID conducts realistic exercises to run through institutional ramp up responses or workflows in managing one or more simulated EID patients either in a peacetime or a crisis scenario. One example of a peacetime scenario involves a single patient. NCID conducted exercise in collaboration with TTSH simulating a person suspected of a highly infectious emerging disease detected at the Emergency Department (ED) and using a Portable Medical Isolation Unit (PMIU) to safely transport the suspect case from TTSH ED to the HLIU at NCID for definitive care.

Another example of a system level exercise is simulating a crisis scenario in a full hospital response exercise depicting a large scale disease outbreak operation that requires responses from critical departments to coordinate and manage one or a large number of suspect patients affected by an EID. This type of exercise involves integration of all functional areas, command and control, and coordination at institutional/hospital level across departments, and with cross-institutional support such as paediatrics management support from KKH and NUH for centralised management of EID patients in NCID. Such inter-cluster collaborations are important to ensure a more coordinated and effective outbreak response at the national level.

The planned full hospital exercise could not be carried out due to COVID-19 but with the proper training and operations system already set in place, this put NCID in a good stead to effectively respond to the COVID-19 activation, and also effectively coordinate and sustain the complex and multifaceted crisis with partner agencies for the national level operations.

It is important to assess the various drills and exercises to draw learning points and improvements for managing EID patients and operations. Similarly, NCID's training approach is constantly reviewed for enhancements and maintenance of training packages.

## HARNESSING HEALTHCARE TECHNOLOGY

NCID piloted the Real-Time Location System (RTLS) in July 2019 which is meant to be a real-time tracking system for staff, patients and visitors to allow the centre to take timely and targeted measures against the spread of infectious diseases. The RTLS is designed to provide rapid, accurate and reliable contact tracing to control any infectious disease outbreak and was progressively rolled out in phases.

### Tracking of patients and staff

RTLS staff tags have been issued to all medical and nursing staff, and staff in key support services in NCID. The RTLS

enables tracking of precise movements of staff, as well as visitors and patients in the clinical areas of NCID with a tag, logging information about the people that they had come into contact with while on the premises, where the interaction took place and for how long. This would facilitate rapid and reliable contact tracing in a disease outbreak so that necessary actions can be taken quickly to curb transmission.

During the COVID-19 pandemic, RTLS tags were used in the Screening Centre, facilitating the tracking of patient movement and contact tracing of contacts when a patient is identified as COVID-19 positive. The RTLS has enabled NCID to triangulate contacts derived from other modalities of contact tracing in the Screening Centre. The system is also useful in contact tracing to identify if there is any exposure to staff in the clinical areas. Doctors, nurses and support services staff deployed to outbreak wards were also issued with RTLS staff tags and this facilitated the contact tracing of staff movement when required.

### Monitor hand hygiene of healthcare workers

The RTLS has another important function to help monitor the hand hygiene of healthcare workers. Pressure sensors are placed under hand sanitisers and hand wash dispensers. If healthcare workers do not complete the hand hygiene procedure before or after interacting with a patient, their RTLS staff tag will alert the staff with an audio reminder to practice good hand hygiene.

### Tracking hospital assets

The system facilitates asset tracking in NCID. Equipment such as wheelchairs and beds are tagged, making it easy to locate and recall the equipment for use especially in an emergency or an outbreak. It would also facilitate the process of returning the equipment deployed after an outbreak.



# COMMUNITY ENGAGEMENT

NCID plays an important role in building community outbreak preparedness through various initiatives, programmes and training courses to educate, inform and promote greater awareness of infectious diseases, knowledge on disease control and management capability to handle infectious diseases. NCID’s community engagement programmes are designed to benefit different stakeholder groups such as community-based care providers, government agencies, medical professionals, and the general public especially the elderly and those vulnerable to infectious diseases. For some of these programmes, NCID worked with partners to leverage their expertise as well as to tap their networks to benefit a broader cross-section of people.

## PUBLIC HEALTH EDUCATION PROGRAMMES

NCID’s public education programmes are designed to increase community awareness of diseases that continue to pose significant risk to public health and have significant impact on the well-being of the population. These include dengue, Human Immunodeficiency Virus (HIV), influenza and COVID-19.

For World AIDS Day 2019, NCID’s Clinical HIV Programme organised a Human Library Event with the aim to foster understanding of HIV and reduce stigma and prejudice. NCID staff manned exhibition booths where the public could learn more about the disease and the stigma faced by people living with HIV (PLHIV) or their caregivers.

In March 2020, the Training and Education Office (T&E) under the Infectious Disease Research and Training Office supported the efforts of some religious organisations to educate and inform their members on COVID-19 precaution and safe practices by developing FAQs for their dissemination.

Increasingly, NCID utilises internet-enabled meeting platforms to hold promotion and education programmes virtually, including community engagement activities to reach a wider audience from diverse groups and at different locations.

T&E conducted two webinars in collaboration with Agency for Integrated Care (AIC) in May 2020 on infection prevention, control and clinical guidance in respect of COVID-19

which were attended by more than 1,000 participants comprising nurses, infection control champions, doctors and allied health professionals from nursing homes and community care services. Two other similar webinars organised with the Ministry of Social and Family Development benefited more than 100 infection control champions, nurses and doctors working with sheltered homes.

Another webinar was a talk on 30 September 2020 which was organised with the Clinical HIV Programme for more than 30 community care nurses to learn more about the clinical aspects of HIV and the social challenges faced by PLHIV.

Several other webinars organised by T&E were also successful in reaching out to varied groups of audiences. These included a webinar themed “Surviving COVID-19” held in August 2020, which focused on swab tests, and prevention procedures such as the use of masks. Some 120 participants from centre-based care providers, a nursing home and the public attended the session.

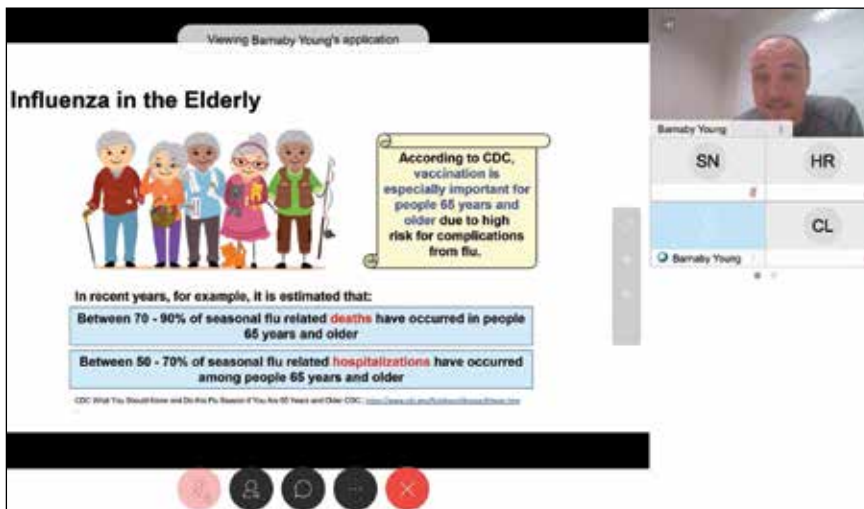
Schools are an important avenue to educate students about infectious diseases and the students, in turn, can share the information with their family and friends. T&E organised a COVID-19 Webinar for Ministry of Education’s (MOE) junior college biology teachers on 27 November 2020. Thirty-two biology teachers and MOE headquarters subject designers attended the session which covered several topics including biology, epidemiology, clinical and public health challenges of COVID-19, and living in a post COVID-19 world.

Even though we were battling COVID-19 in 2020, it is still important to remind the community about preventing the spread of other infectious diseases. T&E organised two webinars on the management of dengue in August 2020. The first session on “Coping with Dengue” was held on 14 August. Around 110 participants comprising residents or clients from centre-based care providers learnt about the signs and symptoms of dengue, and to take note of the critical period. They also



Webinar titled “Coping with Dengue”





Webinar on Influenza and Pneumococcal Vaccination for Older Adults

learnt about self-monitoring of vital signs, fluid intake and urine output and what to look out for if they were in the dengue hotspot areas. The second session on 15 August focused on evidence-based management of dengue in outpatient and inpatient settings and attracted the participation of more than 1,000 clinical professionals.

T&E organised two webinars in November 2020 on influenza and pneumococcal vaccination, in line with the national effort to encourage the uptake of influenza and pneumococcal vaccinations particularly among the elderly. The session on 6 November was co-organised with Tan Tock Seng Hospital for more than 200 nursing home residents and their relatives, as well as elderly participants under the Singapore Heart Foundation Cardiac Rehabilitation Programme. The webinar on Influenza & Pneumococcal Vaccination for Older Adults on 11 November was held in collaboration with AIC for around 230 nursing home management and care staff so that they could encourage nursing home residents to take up these vaccinations.

## PUBLIC HEALTH TRAINING PROGRAMMES

To enhance community preparedness in managing and preventing infectious disease outbreaks, NCID provides

training and resources to equip private and public organisations with specific disease management knowledge and skills. While many of the courses conducted in 2020 addressed specific needs by different segments of the community in managing COVID-19, there were also other courses which were part of NCID's ongoing efforts to train stakeholders in infectious disease prevention and management.

As COVID-19 is a novel coronavirus, some public and private organisations might not have the necessary knowledge and skills to manage the virus and protect their staff and

the people they serve. NCID was able to provide training to support these organisations in adopting best practices in managing the virus. NCID collaborated with Community Care Facilities (CCFs), Swab Isolation Facilities (SIFs), and private and community hospitals to provide training on using Personal Protective Equipment, N95 mask fitting, infection control, hand hygiene, and nasopharyngeal, nasal and throat swabbing for staff working at these facilities. In addition, NCID also provided advice on the design of facility and process flows at CCFs and SIFs and cruise ship facilities to enhance infection control and reduce infection risk.

In collaboration with the National Environment Agency, NCID conducted four training sessions in November and December 2020 to equip funeral service operators and embalmers with basic infection control knowledge when handling bodies of deceased persons infected by COVID-19 and other highly infectious diseases such as MERS-CoV and Ebola. As of 31 December 2020, these courses have benefited more than 50 professionals from the funeral service industry.



Infection Control Course for Handling Bodies with Infectious Diseases



## COMMUNITY ENGAGEMENT



Photo Courtesy of Write Editions®

Handicraft work as part of diversional therapy at NCID Cares

### ON-GOING COMMUNITY ENGAGEMENT ACTIVITIES

NCID Cares is a community arm under the Infectious Disease Research and Training Office. It evolved from the Patient Care Centre (PCC) which was set up more than two decades ago as a hospital-based programme to integrate clinical and community care for patients, including PLHIV. Today, NCID Cares has taken on a larger role in community engagement through centre-based care, and to create greater awareness of infectious diseases and outbreak response through public education and community outreach with the aim of preparing the community for infectious disease outbreaks.

NCID Cares provides centre-based activities and services to support patients with infectious diseases to maximise positive social impact through building self-confidence and opportunities to learn and engage the public, and destigmatise infectious diseases such as HIV and Tuberculosis. There are various patient rehabilitation and support programmes under NCID Cares to help needy PLHIV. One of the programmes is the Red Ribbon Project which was initiated in 1999 to help rebuild self-confidence and self-esteem of PLHIV and integrate them into society. The programme equips patients with life skills through interacting with others from different cultures and environments and helps

them cope with psychosocial needs by focusing mainly on handicraft work as part of diversional therapy. This programme is funded through the sale of handicrafts made by patients and donations from individuals and organisations.

Other programmes include a nutritional programme which provides basic food items through monthly food rations for needy patients with HIV, to ensure that their basic nutritional needs are taken care of; medication and non-standard drug subsidies; as well as education and volunteer programmes including training programmes for volunteers, women's and men's support groups, and HIV orientation programme for patients who are newly diagnosed with HIV.





## LOCAL AND INTERNATIONAL COLLABORATION

Preventing and managing known and emerging infectious diseases and pathogens is complex and requires a multifaceted and multidisciplinary approach. At NCID, we believe in engaging with and building a network of partners in the local, regional and international healthcare and research ecosystems to prepare for and respond to any disease outbreak. To this end, NCID has been strengthening its connections with local healthcare partners and regional health systems in Singapore. NCID is also building up regional and international networks and leveraging global platforms and opportunities to reach out to partners overseas for collaborative research.

### LOCAL AND NATIONAL COLLABORATION

In May 2018, NCID formed a multidisciplinary Paediatrics (Obstetrics/Neonates) Infectious Diseases (ID) Workgroup with KK Women's and Children's Hospital (KKH) and National University Hospital (NUH) to provide expert guidance on outbreak preparedness response plans for the management of paediatric, obstetric and neonate patients. The operational preparedness and recommendations from the Workgroup aim to enhance NCID's and Singapore's outbreak response capability for this group of patients, including ongoing staff training and preparedness, recommendations for policy development, and resource planning. During the COVID-19 pandemic, members of the workgroup provided expert inputs for policies on the management of family clusters and obstetric patients.

NCID also collaborated with external agencies such as National Heart Centre Singapore/Singapore General Hospital (NHCS/SGH) and NUH for cross-institutional support and on training plans to maintain readiness in Extracorporeal Membrane Oxygenation (ECMO) to care for adult COVID-19 patients.

NCID worked with experts from the Health Sciences Authority (HSA) and other public healthcare institutions on COVID-19 therapies and interim treatment guidelines. Another area of national level collaboration was in COVID-19 research through the National COVID-19 Research Workgroup, which brought together researchers, clinicians and

representatives from NCID, Agency for Science, Technology and Research, National University of Singapore, Duke-NUS Medical School, Ministry of Health (MOH), National Research Foundation (NRF), NUH, Nanyang Technological University, National Medical Research Council (NMRC), DSO National Laboratories, Singapore Clinical Research Institute, and National Healthcare Group.

To facilitate exchange of knowledge, NCID hosted a number of visits in 2019 and at the beginning of 2020 for government agencies including Ministry of Education, MOH, NMRC, and NRF, and healthcare institutions including Changi General Hospital, Institute of Mental Health, Khoo Teck Puat Hospital, KKH, NUH, Sengkang General Hospital, SingHealth Community Hospitals, SGH, and Woodlands Health Campus.



Woodlands Health Campus team visited NCID facilities including the operating theatre



Visit by Changi General Hospital where the team toured the High Level Isolation Unit

\* Photos of the visits were taken in 2019



## LOCAL AND INTERNATIONAL COLLABORATION

### REGIONAL AND INTERNATIONAL COLLABORATION

NCID actively sought the expansion of our expertise network with countries in the region and globally through knowledge exchange on research and therapies, including the sharing of infectious disease expertise and advice on surveillance, epidemiology and clinical management of COVID-19 with other countries and national centres.

To further knowledge sharing, NCID participated in several video conferences with overseas counterparts such as US Centers for Disease Control and Prevention (US CDC), Chinese University of Hong Kong, Hospital Sungai Buloh in Malaysia, Korea Disease Control and Prevention Agency, and Texas Children's Hospital. The discussions focused on testing methods, clinical management, current and potential therapeutics, care needs of patients, epidemiological analyses, and research developments.

In July 2020, NCID led a regional expert panel discussion on optimal treatments for COVID-19 which consisted a panel of regional experts from Hong Kong, Japan, India, Taiwan, Brunei, China, Indonesia and Malaysia, as well as local experts from NCID, NUH and SGH.

In November 2020, NCID joined the Global Outbreak Alert and Response Network (GOARN). This global technical partnership, established by the World Health Organization (WHO), is key in engaging the resources of technical agencies beyond the United Nations for rapid identification, confirmation and response to public health emergencies of international importance. NCID's participation will place us in better stead to support public health emergency response on a global platform. NCID's clinicians are also serving on various WHO panels such as for infection control, vaccination and bioterrorism.



NCID played host to distinguished speakers from the Options X for the Control of Influenza conference

\* Photos of the visits were taken in 2019



The team from Princess Margaret Hospital Hong Kong was given a tour of Clinic J, Screening Centre and the High Level Isolation Unit

Another example of NCID's international collaboration is with the National Emerging Special Pathogens Training and Education Center (NETEC; funded by US CDC, which has been ongoing since 2017, for best practices related to national outbreak response and safe containment of high consequence pathogens and novel pathogens. NCID is one of the founding members of the Global Infectious Disease Prevention Network (GIDPN), formed in 2017, to share best practices and explore development of a clinical trials network and clinical response force. The network, which comprises partners from the United States (US), Africa, China, South Korea and Singapore, ensures rapid information- and resource-sharing during outbreaks of highly hazardous communicable diseases.

In 2019, we welcomed regional and international experts and visitors to our state-of-the-art facility. Some of these visits were from government agencies such as Malaysia's National Public Health Laboratory and Thailand's Ministry of Public Health; universities including Japan's International University of Health and Welfare School, University of Hong Kong, Imperial College London; and healthcare institutions including Princess Margaret Hospital Hong

Kong and South Korea's Asan Medical Center, the US National Institutes of Health (NIH), the US Office for the Coalition of Epidemic Preparedness Innovations, the US CDC, and WHO.

NCID was also privileged to host lectures by Professor David Heymann of the London School of Hygiene and Tropical Medicine on the Global Overview of Communicable Diseases; Dr David Henderson, then-Deputy Director for Clinical Care for the NIH Clinical Center in the US on *Sphingomonas koreensis* Infections; Dr Teo Chong Gee, the Distinguished Consultant and Chief of Viral Hepatitis Laboratory at US CDC from 2005 to 2015 on Viral Hepatitis Elimination: Expectations and Reality; and Professor Jon Friedland, Deputy Principal (Research and Enterprise) at St. George's, University of London on Tuberculosis and Tissue Damage in the Patient. NCID also hosted ASEAN delegates who were in Singapore to learn about cross-border migration in Asia and Tuberculosis under the Singapore-United States Third Country Training Programme.

These opportunities to interact with international experts, institutions and agencies were important avenues for NCID to build relationships with our international partners and pave the way for future collaborations.



At NCID, we have a dedicated team who truly embraces our vision to stay strong, trusted and united in upholding our mission to protect the people of Singapore from infectious diseases. Our efforts are underpinned by our core values of nurturing, compassion and collaboration, integrity and innovation, and dedication that drive our passion to give our best in clinical care, public health, as well as in research, training and community engagement, especially during the COVID-19 pandemic.



NCID year-end party 2019



Nurses' Day and PSA Day Celebration



World Pharmacist Day

## STAFF ENGAGEMENT

At NCID, staff engagement activities help to build a cohesive team and keep the spirit strong.

### Celebrations

#### NCID year-end party, 6 December 2019

NCID celebrated the end of an eventful year with a party themed "Glitz & Glam" which was held at the Screening Centre.

#### Valentine's Day walkabout, 14 and 15 February 2020

NCID received lots of flowers from the public for Valentine's Day. NCID senior leadership visited various departments to distribute flowers to staff to show appreciation for their efforts in battling COVID-19.

#### Nurses' Day and PSA Day Celebration, 4 August 2020

NCID celebrated Nurses' Day and Patient Service Associate (PSA) Day to show appreciation for the dedication and hard work of all nurses and PSAs in caring for patients during COVID-19. NCID senior leadership distributed treats hampers to the wards and Clinic J during a walkabout.

#### World Pharmacist Day, 14 October 2020

NCID senior leadership celebrated World Pharmacist Day with pharmacists at the outpatient pharmacy, inpatient pharmacy and the pharmacy store.

## NCID year-end party, 11 December 2020

The virtual year-end party themed “Masked Heroes” paid tribute to all the heroes of NCID. Staff enjoyed the ice-breaker games, hidden talent competition and photo flashbacks of activities and events during the eventful year. The exchange of appreciation notes among staff was meaningful in light of the efforts and teamwork by the different units during the year.

## Dialogues

### NCID Town Hall, 26 August 2020

The virtual Town Hall was the first since the NCID official opening and held in the

midst of the COVID-19 pandemic. The session included updates on the many critical aspects of work performed by NCID related to COVID-19, including research and operations. The Q&A session was an enriching discussion about moving NCID forward and our identity. Senior leaders also shared anecdotes and personal experiences of their work in battling the pandemic.

### Dialogue sessions with Executive Director of NCID in 2020

Dialogue sessions were resumed starting with the Infectious Disease Research and Training Office on 7 October, Clinic J on 2 December and National Public Health and Epidemiology Unit on 15 December.



Staff appreciation session



NCID Town Hall



New Hire e-Orientation

These sessions conducted via video conferencing allowed Executive Director, Professor Leo Yee Sin to have a more intimate engagement with the departments, by sharing each other’s thoughts and challenges faced. The sessions have also enabled the participants to learn about one another on a more personal level.

## Appreciation

### Staff appreciation session, 1 July 2020

At the session held through video conferencing, Executive Director, Professor Leo Yee Sin and NCID senior leadership expressed their thanks to staff for their dedication and hard work in responding to the pandemic. After the session, all staff received snacks as a token of appreciation.

## Orientation

### New Hire e-Orientation, 12 August 2020 and 11 November 2020

Executive Director, Professor Leo Yee Sin and several NCID senior leaders welcomed new staff over virtual e-orientation sessions that touched on NCID’s leadership, mission, vision and core values. Participants also got to know one another better by sharing their experiences and background.





## AWARDS WON BY STAFF

Since its official opening in September 2019, NCID staff have been recognised for their efforts and outstanding achievements in their respective fields. The following is a list of awards won by our staff.

### RESEARCH

#### National Medical Research Council Awards

##### FY2019 NMRC Clinician Scientist Award (Investigator)

- Associate Professor Ng Oon Tek, Senior Consultant
- Associate Professor Angela Chow, former Director, National Public Health and Epidemiology Unit

##### NMRC Research Training Fellowship

- Dr Chia Po Ying, Consultant

#### NHG Research Awards 2019

##### Outstanding Research Impact Award

- Professor Leo Yee Sin, Executive Director
- Associate Professor David Lye, Director, Infectious Disease Research and Training Office

##### Outstanding Research Mentor Award

- Associate Professor Angela Chow, former Director, National Public Health and Epidemiology Unit

#### NHG Research and Innovation Awards (NRIA) 2020

##### NHG Research Impact Award

- Associate Professor David Lye, Director, Infectious Disease Research and Training Office
- Dr Barnaby Edward Young, Head, Singapore Infectious Disease Clinical Research Network, Infectious Disease Research and Training Office

### TEACHING EXCELLENCE

#### NHG Teaching Award for Senior Doctors (2019)

- Associate Professor Lee Cheng Chuan, Senior Consultant

#### NHG Teaching Award for Junior Doctors (2019)

- Dr Lee Pei Hua, Senior Resident

#### NHG Teaching Award for Pharmacy Senior Preceptors (2020)

- Grace Hoo Si Ru, Senior Pharmacist (Specialist)

#### NHG Teaching Award for Pharmacy Preceptors (2020)

- Audrey Goh Wei Ling, Senior Pharmacist
- Gavin Cheah Jia Sheng, Senior Pharmacist
- Jessalyn Chan Mei Xuan, Senior Pharmacist

#### NUS Medicine Junior Doctor Teaching Award

- Dr Tay Jun Yang, Senior Resident

#### Nanyang Technological University (NTU) Nanyang Education Award (School) (2019)

- Associate Professor Lim Poh Lian, Director, High Level Isolation Unit

### SERVICE TO NATION AND HUMANITY

#### National Day Awards 2020

##### Public Administration Medal (Silver)

- Professor Leo Yee Sin, Executive Director

##### Public Administration Medal (Bronze)

- Associate Professor Raymond Lin, Director, National Public Health Laboratory

#### Commendation Medal

- Dr Cui Lin, Senior Principal Scientific Officer, National Public Health Laboratory

#### Long Service Medal

- Sugunavalli d/o Bhoopalan Thevar, Senior Staff Nurse I, Specialist Clinic K

#### Healthcare Humanity Award 2020 (with Honourable Mention)

- Associate Professor Lim Poh Lian, Director, High Level Isolation Unit

### LONG SERVICE

#### MOH Appreciation & Awards Ceremony – Long Service Award

- Professor Leo Yee Sin, Executive Director
- Associate Professor Brenda Ang, Senior Consultant
- Associate Professor Raymond Lin, Director, National Public Health Laboratory
- Associate Professor David Lye, Director, Infectious Disease Research and Training Office
- Law Hwa Lin, Principal Pharmacist (Specialist)
- Dr Ho Lai Peng, Principal Medical Social Worker

#### Staff Recognition Award 2020

45 staff reached career milestones at NHG

##### 30 years

- Associate Professor Lee Cheng Chuan, Senior Consultant
- Dr Margaret Soon, Director of Nursing
- Suriani Bte Mohd Salim, Senior Staff Nurse I

##### 20 years

- Radin Ibtisam Bte Main, Executive Assistant
- Rokiah Bte Ali, Health Attendant
- Li Caihua, Nurse Clinician I
- Law Hwa Lin, Principal Pharmacist (Specialist)

### PUBLIC HEALTH EDUCATION

#### Best Poster Presentation at the 14th Singapore Public Health & Occupational Medicine Conference

- Ang Li Wei, Principal Medical Statistician, National Public Health and Epidemiology Unit

### PROFESSIONAL DEVELOPMENT

#### NHG-LKC Medicine Clinician-Scientist Fellowship

- Associate Professor Ng Oon Tek, Senior Consultant
- Dr Mucheli Sharavan Sadasiv, Consultant

#### MOH Nurses' Merit Award

- Naw Than Win, Nurse Manager I

### COMMUNITY

#### Agency for Integrated Care's Friends of the Community Care Award – Special Mention Category

- National Public Health Laboratory



NCID Doctors



NCID Nursing



Clinic J



NCID Pharmacy

\* To keep in line with safe management measures, each group photo may not consist of the full team.





Care and Counselling



Antimicrobial Resistance Coordinating Office



Executive Director's Office



Infectious Disease Research and Training Office

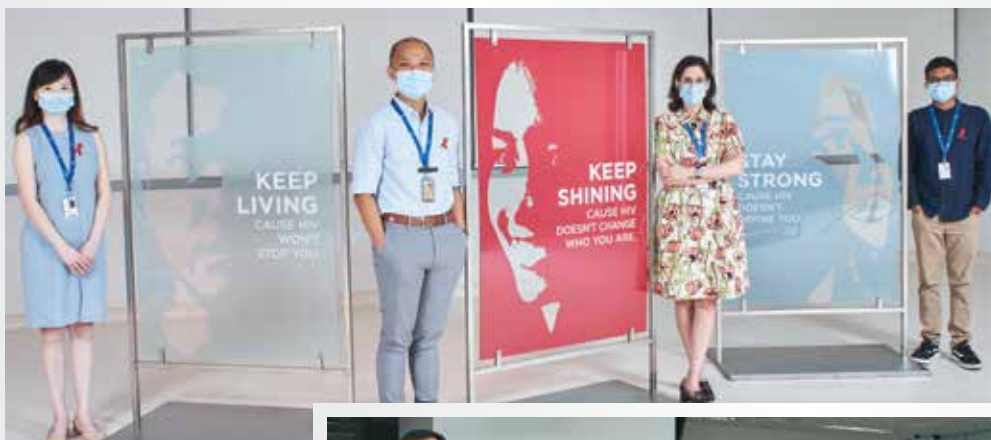
\* To keep in line with safe management measures, each group photo may not consist of the full team.



National Public Health and Epidemiology Unit



National Public Health Laboratory



National HIV Programme



National Tuberculosis Programme

\* To keep in line with safe management measures, each group photo may not consist of the full team.



Our appreciation to Henry Lim from Tan Tock Seng Hospital Communications, Write Editions®, Pearl Gan, and staff of NCID who contributed photos to this book.

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