



NCID News

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NCID officially opened on 7 September 2019 and just a few months later we were called on to be at the forefront of Singapore's outbreak efforts when the viral pneumonia, COVID-19, reached our shores in January this year. With its state-of-the-art facilities and integrated structure of clinical, public health, research and training functions, NCID was built to respond to outbreaks.

In this issue, we bring you an exclusive look into how our integrated outbreak capabilities, from clinical expertise to diagnostics, and operations, served to fulfill NCID's mission of protecting the people of Singapore from infectious diseases during the COVID-19 pandemic. NCID's journey from before, during and beyond the pandemic, are featured in an extensive photo-story within the pages.

Our expertise in research, and therapeutics, supported by multiple local and international collaborations, has scaled up in academic rigor to contribute to a growing body of scientific evidence on COVID-19. We highlight how our research studies and clinical trials have helped us better understand the virus behaviour, transmission, impact on host and society, as well as plausible therapeutics to support outbreak efforts with evidence-based management.

We also bring you an overview on how community response to the pandemic has been

a critical pillar in Singapore's efforts to fight the novel pathogen and how we must maintain our community resilience and protect our community as the battle continues.

On behalf of the NCID leadership team, I would like to thank and commend all staff for their commitment, resilience and teamwork displayed throughout the course of this pandemic. Besides our front liners, a team of allied health professionals, administrative and axillary services staff stand strong in working together to manage this pandemic and have done a remarkable job. We understand our mission, vision, and core values and will continue to step up to fight this virus.

The SARS-CoV-2 virus is a tricky one. It is elusive in nature, racing ahead of us for now and until we get above it, we will have to continue to adapt to new norms and work together as a community to ensure our population's safety. While the world is working on a vaccine, it is not the panacea to address all challenges posed by SARS-CoV-2. Good hygiene practices, mask-wearing and safe distancing remain as part of our routine lifestyle. Our systems are strong and ready to take on whatever the next challenge may be.

PROFESSOR LEO YEE SIN
EXECUTIVE DIRECTOR
NATIONAL CENTRE FOR INFECTIOUS DISEASES

THE COVID-19 DIARIES A PICTORIAL ACCOUNT OF NCID'S OUTBREAK EXPERIENCE

By Emma Seow, Manager, Executive Director's Office at NCID

“Every outbreak is different. We learn from every outbreak and emerge stronger and better prepared for the next one.”

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

NCID which was built for one purpose - to fulfil the national mission of protecting the people of Singapore from infectious diseases truly fulfilled its mission during the COVID-19 outbreak. The unique integration of clinical capabilities, academic research and training, and public health functions allowed the organisation to develop synergies internally and with other agencies to better serve our patients and the residents of this country.

COVID-19 Timeline

DECEMBER 2019

31 Dec: NCID and MOH begin development of diagnostic assays and outbreak management plans as well as guidelines for local physicians to combat COVID-19

JANUARY 2020

21 Jan: 'DORSCON level raised from green/ yellow to yellow/ orange'

22 Jan: Multi-ministry taskforce set up

23 Jan: First confirmed case in Singapore, admitted to SGH

24 Jan: Second confirmed case in Singapore, first to be admitted to NCID

29 Jan: 24-hr Screening Centre at NCID opens for screening of suspect cases

30 Jan: WHO officially declares the outbreak as a Public Health Emergency of International Concern

31 Jan: First Singaporean to contract COVID-19 arrives in Singapore and warded at NCID

FEBRUARY 2020

4 Feb: First cases of local transmission reported. First recovered case in Singapore discharged from NCID

7 Feb: DORSCON level raised from yellow to orange

18 Feb: Public Health Preparedness Clinics activated.

MARCH 2020

11 Mar: WHO officially declares COVID-19 as a pandemic

19 Mar: Tent set up outside NCID Screening Centre to cater to more patients. NCID scales up inpatient capacity.

21 Mar: First two deaths in Singapore reported.

24 Mar: Setup of Community Care Facilities

APRIL 2020

7 Apr: Singapore enters Circuit Breaker mode: workplaces closed except those providing essential services, schools moved to full homebased learning.

JUNE 2020

2 June: Start of Phase 1 of Safe Re-opening in Singapore

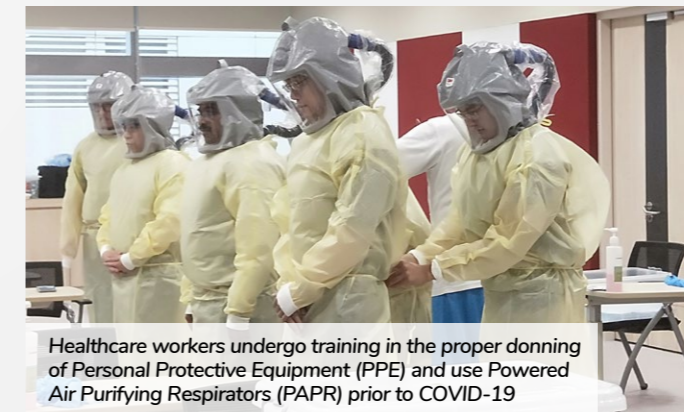
19 June: Phase 2 begins

Gearing up our healthcare workers >

Ensuring Singapore's outbreak readiness is key for NCID, since Singapore is a small country and a large-scale, prolonged outbreak would easily involve significant contributions from the healthcare workforce across the nation.

Preparation and capability-building started way before any outbreak or pandemic, and has been ongoing. As part of its national mandate, NCID has been training healthcare workers both within and beyond the Novena Healthcare campus in areas such as infection control, proper donning and doffing of various levels of personal equipment, proper use of a Powered Air Purifying Respirator, conducting nasal and throat swabs, care of patients with oxygen and higher acuity needs, and much more.

NCID has also conducted drills and simulations of outbreaks regularly during peacetime to enhance preparedness. This is to ensure that staff throughout Singapore are safe and ready for an outbreak/pandemic at any time.



Healthcare workers undergo training in the proper donning of Personal Protective Equipment (PPE) and use Powered Air Purifying Respirators (PAPR) prior to COVID-19



A healthcare worker dons the full PPE before entering a negative pressure room to care for a COVID-19 patient

Transporting suspect cases safely <

One of the keys to keeping respiratory outbreaks under control is the careful identification and isolation of suspect cases, by transporting them to the NCID Screening Centre or to hospitals, so that they can be separated from the rest of the population while receiving the necessary clinical care.

Ambulance crews are often at higher risk of infection due to their close contact with patients in confined spaces, hence they are well-trained to don the proper Personal Protective Equipment (PPE) to protect themselves and to dispose them properly after use. In addition, they are conscientious about disinfecting the ambulances and equipment after ferrying each passenger.



An ambulance driver disinfects equipment after transporting a suspect case



Constant flow of ambulances transporting suspect cases to the NCID Screening Centre

Undertaking effective screening operations

The Screening Centre at NCID, which was activated on 29 January, is the designated facility for the screening of suspect cases during the COVID-19 pandemic. Individuals visiting the centre are required to queue 2 metres apart for infection control purposes and will be triaged to low and high risk areas based on their symptoms and travel history before being tested. Those who test positive will be admitted.



NCID Screening Centre tentage



NCID Screening Centre team at work



A tent was constructed outside the screening centre to accommodate the growing number of suspect cases in NCID Screening Centre

Providing clinical care to our patients

The multi-disciplinary team of clinicians, nurses and allied health professionals at NCID provide specialised clinical care to patients during peacetime and in outbreaks.

The NCID building is self-contained with a full-suite of clinical services including inpatient wards, an outpatient clinic, diagnostic radiology, operating theatres, ICUs and clinical laboratories, in order to minimise patient and sample movement during outbreaks to cater to patients' needs, reduce infection and provide care in a timely manner.

Further to that, various features within the inpatient wards are designed to limit infection and ensure the safety of our staff, including double-door negative pressure isolation room and ante room resulting in a one-way airflow from the ward corridor to the patients' rooms.

Another unique feature of NCID is the infrastructure capability that allows the number of beds to be scaled up from 330 to more than 500. When the number of COVID-19 cases was rapidly increasing in mid-March, available isolation rooms were quickly converted from single-bedded to double or triple-bedded rooms to admit more patients.



Dr Ho Lai Peng counsels a COVID-19 patient in ICU



Associate Professor David Lye and Dr Ling Li Min discuss care of a patient in ICU



Pharmacists prepare a patient's medication at the inpatient pharmacy.

Providing support through laboratory testing and surveillance

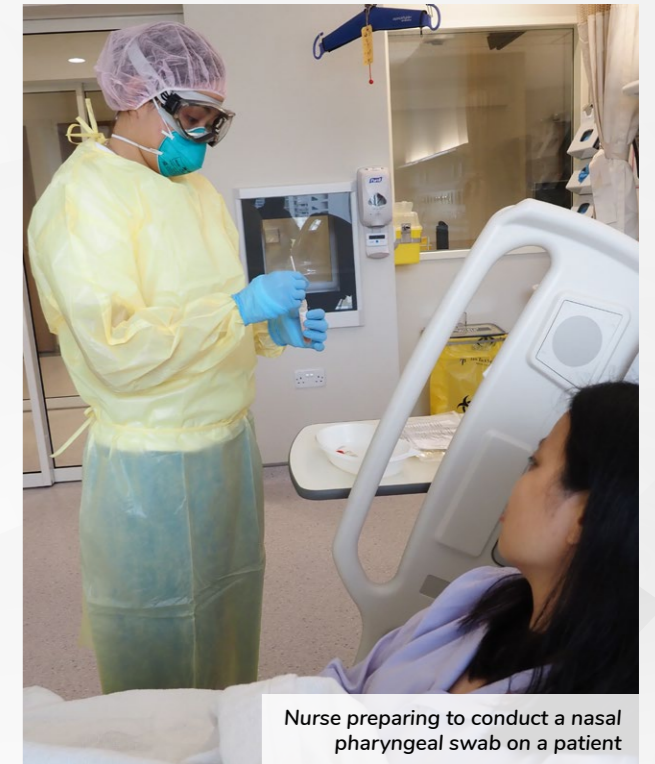
The public health units at NCID serve as a first line of defence in the rapid recognition, testing for and aiding in the diagnosis of emerging and re-emerging pathogens to prevent the spread of infectious diseases.

The National Public Health Laboratory (NPHL) began testing for the disease and implementing pan-coronavirus PCR testing for suspect cases from 2 January. When the new virus, SARS-CoV-2, was confirmed as the causative agent and the virus RNA sequence was released by China, NPHL designed a SARS-CoV-2 PCR assay targeting three genes and optimised the test over the next week, so that the test was ready when the first case was detected in Singapore on 23 January. In addition to COVID-19 diagnostic testing, NPHL performs virus isolation and whole genome sequencing to support public health investigation.

The National Public Health and Epidemiology Unit (NPHEU) began tracking reports of atypical pneumonia clusters arising from Wuhan, China, since early January and subsequently other countries worldwide. This information ensured that the frontline clinical teams at Tan Tock Seng Hospital's Emergency Department and NCID Screening Centre were kept abreast of latest developments. NPHEU was also responsible for collating and analysing clinical information for NCID's daily updates to the Ministry of Health and to guide clinical and operational teams to project ICU and bed capacity to meet increasing demands as well support the establishment of clinical protocols to stratify patients to appropriate levels of clinical care.



Diagnostic tests conducted at the National Public Health Laboratory



Nurse preparing to conduct a nasal pharyngeal swab on a patient

It takes a multidisciplinary team to fight an emerging infectious disease

Healthcare workers all have their part to play when it comes to fighting the novel COVID-19 pathogen. The environmental services team has been busy, regularly cleaning public areas and high touch surfaces more often than usual. There is also the terminal cleaning of patient rooms when COVID-19 patients recover and are discharged, as well as the hydrogen peroxide vapour decontamination of items that needs to be carried out.

In addition, our team of security staff and temperature screeners work hard to ensure the safety of all by providing directions and precautions to patients, despatchers and the public, escorting patients and monitoring visitors' temperatures and travel history.

Fighting the novel pathogen is indeed a challenge, and protecting the population remains paramount. With the many strengths of our diverse healthcare workforce, we shall overcome.



Housekeeping staff disinfecting a negative pressure room after a patient has been discharged

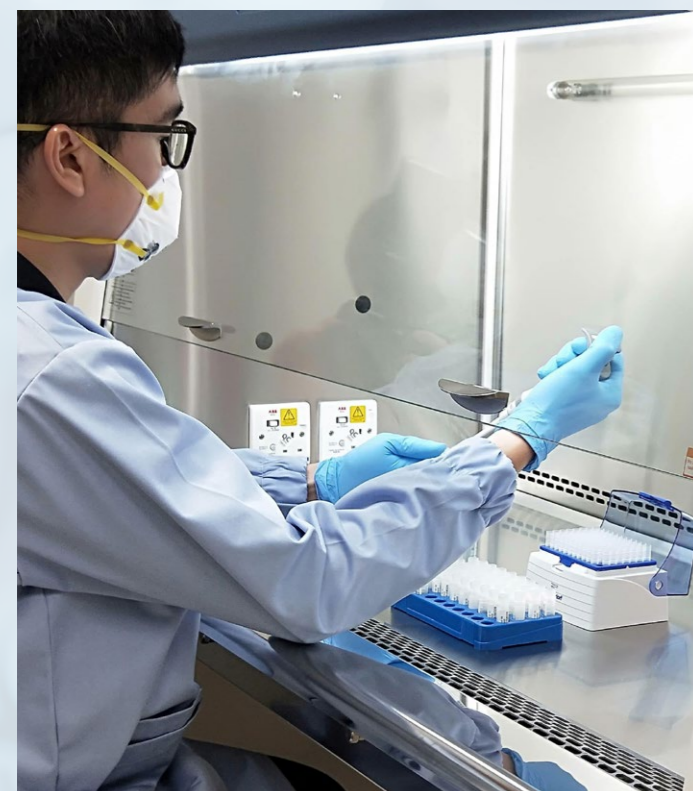
CONTRIBUTING TOWARDS COVID-19 RESEARCH

By Gourie Pandey, Executive, Corporate Communications at NCID and Dr Ramona Gutierrez, Manager, Pandemic Preparedness Research Coordinating Office at NCID

The COVID-19 Research Workgroup was set up in January 2020 to produce studies relevant to understanding COVID-19 transmission in Singapore and has fuelled several of our national research efforts. NCID chairs and hosts weekly discussions of the Workgroup, under Chief Health Scientist (CHS) Prof Tan Chorh Chuan's guidance. To-date, the group has published in local and international journals including *The Lancet*, *JAMA*, *New England Journal of Medicine* and *Singapore Medical Journal*. Through collaborations among several key partners from research institutions, laboratories and experts in vital research areas such as virology, immunology, therapeutics and socio-behavioural sciences, our NCID clinicians and researchers have contributed to the growing body of scientific evidence. We report herein on a few initiatives.

Detecting and characterising COVID-19

A key backbone of the research conducted by NCID and collaborators to better understand the pathogenesis of COVID-19 is through PROTECT, a multi-centred prospective study to detect novel pathogens and characterise emerging infections. This protocol, covering all public hospitals in Singapore, serves as a foundation platform which has enabled the collection of precious information and biological samples for research purposes from more than 500 patients. The first PROTECT patient was recruited on 24 Jan 2020, one day after Singapore reported its first confirmed COVID-19 case, illustrating our early preparedness efforts to promptly gear into action in outbreak circumstances.



PROTECT has allowed us to better understand the virus characteristics, and to develop and validate diagnostic tools as well as study biomarkers for research into immunity during the COVID-19 pandemic. Through collaborations with clinicians and scientists from public hospitals, Duke-NUS Medical School, Agency for Science, Technology and Research (A*STAR), National University of Singapore (NUS), DSO National Laboratories, the research efforts that leveraged on PROTECT have yielded several successful outputs. These include early characterisation and publication of epidemiologic features and clinical course of COVID-19 patients in Singapore¹, as well as the successful development of a first-in-the-world serology test cPass™ launched on 15 May 2020 by Duke-NUS, GenScript and A*STAR².

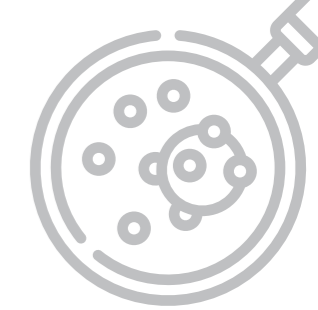
Finding medical therapeutic options

Through early participation in international multi-centre clinical trials investigating the efficacy of promising drugs available to date, we have also contributed towards much needed information on treatment options for COVID-19 patients. NCID participated in three Remdesivir trials - two Gilead Remdesivir trials for moderate and severe disease³ (which have ended) and a National Institutes of Health USA ACTT Remdesivir trial which is ongoing. Remdesivir, which was initially developed as a novel antiviral drug for Ebola, works on an enzyme common in RNA viruses including coronavirus, preventing replication of the virus. It was tested against the SARS and MERS coronavirus and found to be highly effective. Given the structural similarity between SARS and MERS viruses to SARS-CoV-2, the virus that causes COVID-19, Remdesivir may have potential activity against COVID-19 too. This is the first time clinical data for its use in novel coronaviruses is being collected and tested.

The NIH trial is the main definitive trial as it has recruited 1,063 patients and has a placebo control arm, so it will provide unbiased comparison of Remdesivir against standard of care for COVID-19 and NCID coordinated study ACTT-2 is currently still running. In addition, Health Sciences Authority (HSA) has approved the use of Remdesivir in Singapore and NCID is working closely with HSA and Ministry of Health (MOH) on the treatment of patients with the drug outside of trial setting.

Conducting seroepidemiological studies

Amidst the ongoing COVID-19 pandemic, NCID has coordinated three seroepidemiological studies aimed to determine the effectiveness of COVID-19 control measures in the long haul, to provide information to identify which proportions of the population are susceptible to being infected and will benefit from vaccination, as well as to give insight into underdiagnosed mild symptomatic cases that may contribute to the spread of the coronavirus.



Tan Tock Seng Hospital (TTSH), National University Hospital (NUH), Duke-NUS Medical School, KK Women and Children's Hospital (KKH), National University Polyclinics (NUP) and National Healthcare Group Diagnostics (NHGD) have all contributed samples to the national effort. Initial results provide strong evidence that infection control and prevention procedures in Singapore's public healthcare hospitals have been adequate to protect frontline healthcare workers. Preliminary results have shown limited community transmission of COVID-19, which suggests low community immunity at this time in the pandemic. The study follow-up is expected to be till the third quarter of 2021.

Understanding socio-behavioural factors in managing COVID-19

Under NCID's research programme SOCRATES (Strengthening Our Community's Resilience Against

Threats from Emerging infections), novel cohort-based studies to assess the population's knowledge, risk perception, and behaviour during the COVID-19 outbreak in Singapore are currently ongoing. This cohort approach to track public's perceptions provide updates on a near real-time basis, on public awareness of the infectious disease outbreak and behaviours. These socio-behavioural studies conducted in partnership between NCID, NUS and Nanyang Technological University are crucial in providing useful insights into how behaviours evolve during an outbreak in relation to control strategies for better decision-making in countering the COVID-19 pandemic. Some key findings indicate that trust in the government's ability to handle the outbreak and in official government communications has remained high, and that social media is now the dominant source of information for the public. The first survey was rolled out at the end of January 2020 and NCID aims to expand the size of the SOCRATES cohort to about 2,000 individuals.

¹Young, B. E., Ong, S. W. X., Kalimuddin, S., Low, J. G., Tan, S. Y., Loh, J., Ng, O.-T., Marimuthu, K., Ang, L. W., Mak, T. M., Lau, S. K., Anderson, D. E., Chan, K. S., Tan, T. Y., Ng, T. Y., Cui, L., Said, Z., Kurupatham, L., Chen, M. I.-C., ... for the Singapore 2019 Novel Coronavirus Outbreak Research Team. (2020). Epidemiologic Features and Clinical Course of Patients Infected With SARS-CoV-2 in Singapore. *JAMA*. <https://doi.org/10.1001/jama.2020.3204>

²Duke-NUS, GenScript and A*STAR launch first-in-the-world SARS-CoV-2 serology test to detect neutralising antibodies without need of containment facility or specimen, 15 May 2020. Available at: <https://www.duke-nus.edu.sg/allnews/media-releases/duke-nus-genscript-and-a-star-launch-first-in-the-world-sars-cov-2-serology-test-to-detect-neutralising-antibodies-without-need-of-containment-facility-or-specimen>.

³Beigel, J. H., Tomashek, K. M., Dodd, L. E., Mehta, A. K., Zingman, B. S., Kalil, A. C., Hohmann, E., Chu, H. Y., Luetkemeyer, A., Kline, S., Lopez de Castilla, D., Finberg, R. W., Dierberg, K., Tanson, V., Hsieh, L., Patterson, T. F., Paredes, R., Sweeney, D. A., Short, W. R., ... Lane, H. C. (2020). Remdesivir for the Treatment of Covid-19—Preliminary Report. *New England Journal of Medicine*, 0(0), null. <https://doi.org/10.1056/NEJMoa2007764>

Goldman, J. D., Lye, D. C. B., Hui, D. S., Marks, K. M., Bruno, R., Montejano, R., Spinner, C. D., Galli, M., Ahn, M.-Y., Nahass, R. G., Chen, Y.-S., SenGupta, D., Hyland, R. H., Osinusi, A. O., Cao, H., Blair, C., Wei, X., Gaggar, A., Brainard, D. M., ... GS-US-540-5773 Investigators. (2020). Remdesivir for 5 or 10 Days in Patients with Severe Covid-19. *The New England Journal of Medicine*. <https://doi.org/10.1056/NEJMoa2015301>



COVID-19 FRONTLINE IS OUR COMMUNITY

By Associate Professor Steven Ooi, Senior Consultant at NCID's Infectious Disease Research and Training Office and Program Director of the Singapore Field Epidemiology Training Network

What is it like battling COVID-19 in the community? The outbreak has already significantly affected everyone in terms of public health, work life, and social interactions despite efforts to preserve normality as much as possible. Nonetheless, there exists opportunities to improve how we collectively cope. Community partners have collaborated with public health agencies, religious groups, businesses, social enterprises, nursing homes, shelters and welfare organisations to move with changing reality. Throughout, we gathered much experience on preparedness for a new normal, and insights into choices for our common future.

Community family physicians have been among the first to join in the community response to COVID-19. On 14 Feb 2020, shortly after the first cases were documented, the Ministry of Health announced re-activation of the country's Public Health Preparedness Clinics (PHPC). These clinics were established after the SARS outbreak in 2003 and have seen service through past emergencies such as haze events and the influenza pandemic. During peace time, they function as regular medical clinics but clinicians and staff undergo periodic training to stay up-to-date with emergency outbreak protocols.

Our PHPC doctors are serving as first point of contact in the community for individuals with respiratory symptoms. Consultation and treatment fees at PHPCs are subsidised, with Singapore citizens and permanent residents paying \$5-10 out-of-pocket. They must issue patients swabbed under the suspect case definition or enhanced "swab and send home" criteria with MCs that cover till at least 2 days after the date of consultation. In addition, the doctors must explain to their patients that they will be legally required to stay home until notification of their negative test result. Patients with acute respiratory illness who do not undergo a swab test must still be issued with a 5-day MC and are required to stay home for the duration of the MC. This has allowed us to closely monitor and triage potential cases of mild infection in the community.

From Mar-May 2020, infections occurred in residential care settings among the elderly, including those with

limited mobility. Rapid inter-sectoral cooperation led to contact tracing, active surveillance, and infection control at nursing and welfare homes being effectively heightened with public education to keep our vulnerable groups safe. Elsewhere, courageous volunteers stepped out to offer their services as SG Clean public health and safe distancing ambassadors. Retired healthcare professionals, many with needed skills and experience, also returned to work because they care. Other members of the public are coming forward to innovate, entertain, and support as best they know how with creative solutions.

The frontline battle continues as our community seeks normality, grappling with expenses and employment, in a post-circuit breaker world. The community is leveraging not just on our government, but also people-to-people links in social and religious organisations to bridge existing gaps. We will make mistakes, but we must give leeway to discard what does not work without entering into a blame game. We continue to build the ship even as we are already sailing, and must be adaptive in our enterprise. Our pluralistic society is a strength here, for we can learn much from each other when we are open. In addition, there have arisen alternative voices from which to seek advice, and credible non-government sources capable of dealing with critical feedback and building public confidence.

What the community efforts are achieving is to buy all Singaporeans precious time to invest in our social capital to build a stronger and more cohesive society even as we prepare for the new normal. Today, safe distancing and wearing a mask are already acceptable practices. Our future will be one of socially responsible choices, and we must strengthen community consideration for each other. Acts of kindness - people cooperating to help foreign workers, and to cheer on frontline workers with food and messages of care - nourish our hearts with a warm glow of togetherness. Community resilience is built on a network of trust and relationship. Let us use this precious time we have now judiciously!