

Group Research

- At NHG, we put the patient first, and focus on real-world research that directly leads to better health outcomes and quality of life. As such, NHG Group Research works towards three global outcomes: to raise research intensity; to build international peaks of excellence; and to provide real-world evidence to transform population health.

STRENGTHENING PARTNERSHIPS AND GROWING TALENTS IN RESEARCH

RENEWAL OF PARTNERSHIPS TO RAISE RESEARCH INTENSITY

To deliver quality care to patients and populations in the Central-North Region, NHG continues to leverage research and innovation, as well as strengthen existing partnerships and build new ones to drive better health outcomes. Between October 2021 and April 2022, NHG renewed its commitment and support towards:

- #### Palliative Care Centre for Excellence in Research and Education (PaIC)

Jointly set up by NHG, Nanyang Technological University, Singapore (NTU Singapore)'s Lee Kong Chian School of Medicine (LKCMedicine), and Dover Park Hospice, PaIC focuses on two key aspects: providing palliative care education to upskill healthcare professionals in the care of individuals living with life-limiting diseases, and providing support for palliative care research through the annual award of intramural grants. Research at PaIC has improved understanding of integrated models of care, management of end-of-life symptoms, non-cancer palliative care, and support for healthcare professionals in palliative care. In October 2021, NHG renewed the partnership for another three years until FY2023.

- #### Rehabilitation Research Institute of Singapore (RRIS)

RRIS is a translational centre for ageing/rehabilitation research and innovation jointly established by NHG, NTU Singapore, and the Agency for Science, Technology and Research (A*STAR). It brings together research, engineering, and clinical expertise across the three institutions. Leveraging sensors and robotic technologies, RRIS has developed prototypes to assist rehabilitation therapists' work and capture falls, such as a balance-assistive robot that has been piloted at Tan Tock Seng Hospital (TTSH) and other day rehabilitation centres. In April 2022, NHG renewed the RRIS partnership for another two years until FY2023.

- #### Brain Bank Singapore (BBS)

The BBS is a national initiative between NTU Singapore's LKCMedicine, the National Neuroscience Institute (NNI), NHG, and National University of Singapore (NUS)'s Yong Loo Lin School of Medicine. As a brain donation programme and tissue repository, BBS enables future biomedical research to delve into the patho-etiology of neurodegenerative disorders like dementia and neuropsychiatric conditions like schizophrenia. Since its launch, BBS has recruited more than 200 pledged donors and collected four brain and cerebrospinal fluid donations, allowing research in neurological/neurodegenerative and neuropsychiatric disorders to be performed using human tissues. In June 2022, NHG renewed the partnership for another three years until FY2024.

NHG-LKCMEDICINE JOINT APPOINTMENTS

In September 2021, a Memorandum of Understanding (MoU) was inked between NHG and LKCMedicine for no-cost reciprocal appointments. Through the framework, NHG and LKCMedicine would mutually appoint up to 6.0 full-time equivalent (FTE) staff for each discipline of common interest to the other institution. This timely move sets the stage for the joint establishment of an Academic Health System (AHS) in the future, facilitating cross-disciplinary learning and co-development of joint research programmes and translational platforms to raise NHG's research intensity and competitiveness.





Dr Colin Quek, Deputy Director (Informatics) and Principal Research Fellow of RRIS, giving a presentation to Tan Tee How, Chairman, NHG; Prof Philip Choo, Group CEO, NHG; and Dr Tang Kong Choong, Deputy CEO, TTSH.

In October 2021, a new Clinician Scientist Preparatory Programme Plus (CSPP+) was launched to better facilitate CSs in their preparation and transition towards research PhDs, through the provision of seed funding and protected time to enable the generation of preliminary research data.

Concurrently, support to Clinician Innovators (CIs) was also expanded. CIs offer unique insights into addressing clinical needs and improving care delivery, through innovative yet practical ideas that effectively bring together multidisciplinary partners to overcome challenges. In April 2022, an innovation talent development roadmap was launched to provide integrated support for training, mentorship, and funding.

GROWING TALENTS IN RESEARCH AND INNOVATION

Developing staff in research and innovation remains a key strategic thrust of NHG. Since 2012, NHG Group Research has been offering three flagship programmes that provide customised support for basic research training, formal PhDs, and post-doctoral pursuits, making up a comprehensive research talent development roadmap to nurture clinicians into Clinician Scientists (CSs).

SINGAPORE BIODESIGN INNOVATION FELLOWSHIP

In August 2022, NHG selected a new candidate for the Singapore Biodesign (SB) Innovation Fellowship: Dr Violet Hoon, Consultant, Department of Cardiology, TTSH. She follows the footsteps of Dr Chen Kok Pun, Consultant, Department of Gastroenterology & Hepatology, TTSH, who graduated from the SB Innovation Fellowship in 2020 and is the first Biodesign Fellow in NHG.

NHG Innovation Talent Development Roadmap



NHG Group Research's Innovation Talent Development Roadmap provides customised support to develop clinicians in clinical innovation.

DRIVING INNOVATION AND RESEARCH ENTERPRISE SINGAPORE PACT FUNDING

In 2021, Enterprise Singapore awarded NHG's Centre for Medical Technologies and Innovations (CMTi) a new multi-million-dollar funding for five years from CY2021, the third to-date in recognition of the good outcomes achieved by CMTi in CY2020. The renewed funding will strengthen CMTi's capabilities to support NHG clinicians in the following areas:

- Translating ideas into products
- Grooming and nurturing clinician innovators
- Introducing new technologies

As NHG's primary engine that drives innovation and translates ideas into implementable products and solutions, CMTi has facilitated more than 300 projects, and engaged close to 300 clinicians to-date. Together with clinicians, CMTi has attracted industry funding worth more than S\$39 million, spun off 13 companies, filed over 140 patents, licensed more than 70 intellectual property to partners, and commercialised at least 24 products.

INNOVATIONS IN COVID-19 RESPONSE

To meet the immediate needs of managing COVID-19, NHG CMTi launched a one-off COVID-19 MedTech Innovation Grant Call in April 2020 to support clinicians in their medtech development projects. This timely grant provided the much-needed funding for COVID-19-related projects in the areas of infection prevention and control, telemonitoring and rehabilitation, falls prevention and diagnostics, with close to S\$0.5 million in funding awarded.

Since FY2021, the following three projects have been piloted and/or implemented in two NHG Institutions to help create a safe and clean environment for patients and healthcare workers:

- **Sunburst UV Disinfection Robot**
TSSH's Departments of Environmental Services and Infection Prevention and Control collaborated with PBA Systems Pte Ltd to co-develop and validate an enhanced version of the Sunburst UV Disinfection Robot, an autonomous ultraviolet-C (UVC) disinfection robot that disinfects high-touch surfaces in hospital environments.
- **COVID-19 Swab Protection Shield**
The risks of COVID-19 infection increase when high viral loads are exhaled or when healthcare staff spend long periods in close proximity or in poorly-ventilated spaces where particles can remain suspended in the air for an extended period. Dr Angeline Seah, Senior Consultant, Geriatric Medicine, KTPH; and Ms Foo Meow Ling, Senior Nurse Clinician, KTPH, partnered Clifford Dispensary and The Biofactory Pte Ltd to co-develop the COVID-19 Swab Protection Shield for patients during aerosol-generating procedures to prevent the spread of COVID-19 droplets/



The Sunburst UV Disinfection Robot

aerosol. With Singapore transiting towards endemic COVID-19 and the demand for swabs reduced, the team adapted its application to focus on aerosol-generating procedures such as nebulisation.

- **Automated Hospital Cubicle Curtains**
Given the frequent need to handle privacy curtains before and after contact with patients and their surroundings, privacy curtains can pose as a serious risk of transmission of infectious diseases if hand hygiene is inadvertently overlooked. Led by Dr Yong Enming, Consultant at TSSH's Department of General Surgery, a team from TSSH developed and tested an automated curtain device with motorised curtain hooks and sensor control to reduce potential 'touch-based' contamination.

The COVID-19 pandemic has also led to collaborative innovation outcomes in the following areas:

Rise of telehealth to enable access to remote assessment, monitoring, and care for our patients

In collaboration with Taggle Pte Ltd, NHG clinicians from multidisciplinary backgrounds have been working to co-develop Digital Health Applications (DHAs) that allow for remote assessment, monitoring, and treatment to help improve and optimise patient and healthcare outcomes:

- **Heart-track:** A full-fledged virtual mobile application-based multidisciplinary programme built for cardiac rehabilitation that allows patients to exercise independently within their targeted heart rate zone with continuous heart rate monitoring, and empowers them to live a heart-healthy lifestyle with modifications based on their individual risk factors.



The COVID-19 Swab Protection Shield

- **Speech Therapy Digital Suite:** This comprises two applications. The first is a fit-for-purpose digital application designed for speech and voice treatment, which incorporates audio-video conferencing capabilities and allows real-time collection of voice and speech parameters without the need for additional equipment. The other is a comprehensive speech and language rehabilitation platform, which enables speech therapists to provide real-time, simultaneous feedback with an array of local resources in various languages for communication rehabilitation.

The Heart-track, MoveVID, and SERA applications have been identified as initial programmes to be implemented on the NHG HealthApps Platform (HAP), which will pave the way for more DHAs to be developed to meet our population's health needs.

Facilitating accurate and timely healthcare intervention

- Associate Professor Tan Ern Yu, Head of Service, Senior Consultant, Breast and Endocrine Surgery, TTSH, and her team are collaborating with Onkolyze to develop artificial intelligence (AI) applications to improve the accuracy of breast ultrasound assessments. The team has developed algorithms aimed at identifying lesions of concern and which require biopsy for histological confirmation.
- TTSH Nursing and CoNEX Healthcare Pte Ltd collaborated and co-developed the Bedside Alarm Recognition (BAR), which has been designed to sense audio signals produced by medical equipment and relay them to an external alarm for timely intervention by healthcare professionals.

GRANTS TO SUPPORT INNOVATION

CMTi has established two grants that run annually – the NHG CMTi MedTech Grant in February 2021 and the NHG CMTi-NHIC Joint MedTech Grant in May 2019. Both grants support clinicians in developing technologies to translate their ideas into meaningful products and solutions to address unmet needs in healthcare.

- **MoveVID:** An interactive virtual mobile application and telerehabilitation platform that enables patients to have access to a self-directed pulmonary rehabilitation programme, including an educational exercise programme to empower patients to exercise at home for better quality of life.

• Surgical Enhanced Recovery Assistant (SERA):

A perioperative patient journey management application based on Enhanced Recovery After Surgery (ERAS[®]) principles. The application guides the patients in preparing for surgery, and monitors compliance to their tasks and recovery post-surgery.



TTSH Nursing and CoNEX Healthcare Pte Ltd collaborated and co-developed the Bedside Alarm Recognition (BAR).

