

**A DECADE
OF FORGING
HEALTHCARE
INNOVATION
AND BEYOND**

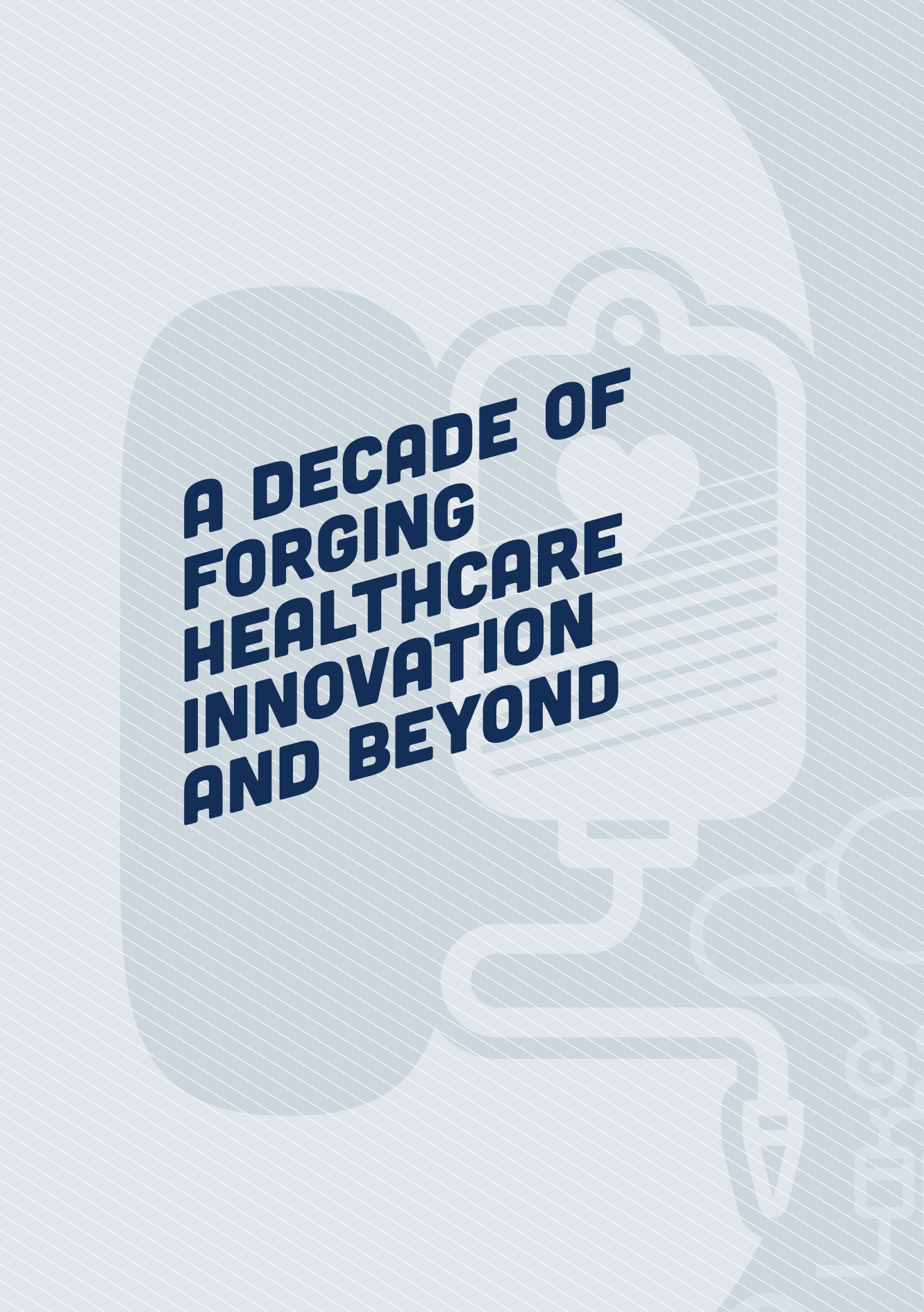
NHIC

ANNIVERSARY



NHIC
National Health Innovation Centre





A DECADE OF FORGING HEALTHCARE INNOVATION AND BEYOND

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A DECADE OF HEALTHCARE INNOVATION

“Since the National Health Innovation Centre Singapore (NHIC) was established in 2014, it has grown to be a vital part of Singapore’s healthcare innovation ecosystem, guiding innovators with ground-breaking ideas from initial ideation to successful implementation.”

Professor Benjamin Ong

Chairman, NHIC Board Oversight Committee

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Dose Statistics Table		Dx Vx Values		Plan Information		Dose Points		Criteria (double-click to edit)		#
Name	Dose (Gy)	Dose (%)	Volume (cm³)	Volume (%)						
	38.79	97.4	0.81					0.7 Volume (%) <= 2.0		0
PTV SBRT Prostate	35.75	89.7	0.00					0.0 Volume (%) <= 2.0		0
PTV Ureter	30.87	77.5	3.69					100.0 Volume (%) >= 90.0		0
PTV Ureter	36.25	91.0	0.00					0.0 Volume (%) <= 5.0, Min: 10.0		0
Rectum	32.63	81.9	0.18					0.4 Volume (%) <= 10.0, Min: 15.0		0
Rectum	29.00	72.8	1.02					2.0 Volume (%) <= 20.0, Min: 15.0		0
Rectum	36.25	91.0	1.68					2.4 Volume (%) <= 10.0, Min: 15.0		0
Bladder	32.63	81.9	5.11					7.4 Volume (%) <= 20.0		0
Bladder	18.13	45.5	20.90					30.2 Volume (%) <= 50.0		0
Bladder	18.13	45.5	0.00					0.0 Volume (%) <= 2.0		0
Femur_L										



Professor Benjamin Ong

Chairman
NHIC Board Oversight Committee



FOREWORD

Innovation has been at the heart of Singapore's healthcare system, which saw improvements over the years, empowering Singaporeans to lead longer and healthier lives, and age with confidence.

In my more than 40-year career in healthcare, I have had the privilege to participate in the development of our healthcare ecosystem. In particular, during my tenure as the Ministry of Health's Director of Medical Services from 2014 to 2020, participating in the growth of our healthcare information systems and assisting the National Medical Research Council, Singapore, to further develop clinical research and innovation. During this time, we opened new public healthcare facilities, transformed healthcare models to meet the needs of Singapore's ageing population, strengthened healthcare regulatory frameworks and introduced health technology assessment capabilities.

Since the National Health Innovation Centre Singapore (NHIC) was established in 2014, it has grown to be a vital component of Singapore's health innovation ecosystem. Through the years, NHIC has partnered with Singapore's public healthcare institutions to facilitate the development and translation of research discoveries and innovations into market-ready products and services to aid in their adoption in healthcare delivery.

The team at NHIC has guided aspiring innovators with ground-breaking ideas from the initial ideation stage to successful implementation.



Beyond its funding programmes, NHIC has provided support and advice, talent development, and networking opportunities with industry experts and potential collaborators, among other extensive support services.

This holistic approach has led to a diverse array of impactful health innovations, significantly enhancing care outcomes in various areas of patient and clinical needs. They range from immunotherapies to technologies that help regain muscular strength and mobility in patients undergoing rehabilitation, and a system that uses artificial intelligence to help doctors triage patients with cardiac symptoms at emergency departments. These examples alone highlight the breadth of healthcare inventions that NHIC has cultivated and contributed to over the past decade.

One of Singapore's key healthcare challenges is a rapidly ageing population, which will require a whole-of-society approach towards healthy lifestyle habits to enable the population to age well in place. This requires a shift to develop a future-ready healthcare system.

To meet these rising healthcare needs, NHIC's enabling role in the healthcare ecosystem will become even more integral. To nurture more impactful innovations that will boost aspects such as manpower-productivity and cost-effectiveness, to continue delivering quality healthcare to Singaporeans and residents at all stages of their lives.



NHIC will strengthen its ability and capacity to identify innovations that will move the needle at the larger, systems level, and carefully shepherd their development towards successful implementation.

As NHIC marks its 10th anniversary this year, the team continues to rise to the occasion. Importantly, it is also shifting the focus, to expand from project-level support to systems-level healthcare transformation, seeding innovation to creating sustainable and scalable healthcare solutions for impact.

With this significant milestone, I invite you to learn about NHIC's decade-long journey as well as our partner organisations' outstanding efforts in healthcare innovation to date, through this commemorative book. Looking ahead, NHIC will build on its work and partnerships with the clinical community and others, and catalyse even more impactful healthcare innovations, to benefit Singapore in the next decade and beyond.

Professor Benjamin Ong

Chairman

NHIC Board Oversight Committee





The Consortium for Clinical Research and Innovation, Singapore (CRIS) was established in 2020 with the goal of strengthening synergies and facilitating collaborations among six key national-level clinical research and translational programmes, one of which is the National Health Innovation Centre, Singapore (NHIC).



PREFACE

When the Singapore Biomedical Sciences (BMS) initiative was launched in 2000, it was focused on establishing the fundamentals – putting in place strong biomedical research capabilities and developing critical talent and research infrastructure. Subsequently, more emphasis was placed on building up translational, clinical research and innovation capabilities.

As Singapore laid the foundation for strengthening basic, translational and clinical research, there was also an increasing need to provide stronger support to take research findings and discoveries through innovation to commercialisation. This led to the establishment of NHIC in 2014 to help commercialise research and innovation efforts within the clinical community.



Professor Ranga Krishnan

Chairman

National Medical Research Council (NMRC)

Chairman

NHIC Board Oversight Committee (2014 – 2023)



Referencing the United Kingdom's National Health System Innovation Hub as a model, NHIC aimed to complement existing Innovation and Enterprise Offices to strengthen the commercialisation capabilities within the healthcare ecosystem.

In the decade following its inception, NHIC has played an integral and

diverse role in facilitating the commercialisation of medical discoveries and technologies from and with the clinical community to address healthcare challenges. It has facilitated crucial connections between our healthcare institutions and industry which have led to fruitful collaborations.

As healthcare trends and goals gradually changed, NHIC has also evolved its support towards addressing new priorities while enabling innovation to deliver health and economic outcomes.



Presently, Singapore faces the challenge of becoming a super-aged society by 2030, with its small population, complex healthcare needs, rising costs and manpower limitations. As such, NHIC's support in the development, commercialisation and adoption of new technologies for healthcare transformation become more essential than ever.

On the occasion of its 10th anniversary this year, this commemorative book highlights some of the advances that NHIC has contributed to, alongside its progress and plans for the future. I hope you will be inspired by the stories of our innovators and how they have made a mark in the clinical ecosystem. I wish NHIC the best as it continues its vital work as a pillar of Singapore's healthcare innovation.

Professor Ranga Krishnan

Chairman

National Medical Research Council (NMRC)

Chairman

NHIC Board Oversight Committee

(2014 – 2023)



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Associate Professor Henry Ho

Executive Director

National Health Innovation Centre Singapore (NHIC)



INTRODUCTION

For a decade, NHIC has connected the two worlds of research and development (R&D) and healthcare delivery. By enabling exchanges between technology innovators and adopters, NHIC has served as a key node for multi-disciplinary healthcare innovation missions.

NHIC's wide-ranging work reflects the breadth and depth of support that it has provided since its inception in 2014. It has assisted in healthcare innovation at every stage of the process, from guiding clinicians with promising ideas and strong clinical practice towards understanding market needs, to helping spin-offs enter the clinic and market locally and internationally. To use an analogy, one could think of NHIC as an aircraft carrier, a base from which to launch multi-disciplinary healthcare innovation missions.

Beyond grant funding, NHIC has provided project guidance to early-stage clinical innovators in intellectual property, regulatory, and business needs, to advance medical innovations towards successful clinical and commercial solutions. Through its support, a variety of healthcare innovations have become impactful products and services, enabling clinical practitioners to better diagnose and treat diseases, empowering patients to better manage chronic conditions, and providing individuals with better means of living healthier lives.



NHIC also facilitates talent development in three areas of competencies: clinical, technical and business. It has also established a strong network of industry partners, under the Clinical Advancement and Development for Research, Entrepreneurship and Enterprise (CADRE²) programme, to guide early-stage clinical teams towards scalable and sustainable business models for greater success.

As NHIC marks its 10-year milestone in 2024, this commemorative book serves to record its progress, and also celebrates successful healthcare innovation stories across Singapore. Each chapter showcases how clinical innovators have made pivotal breakthroughs and turned their visions into practical, viable and effective real-world solutions.

The first half of this book covers five projects that benefitted from NHIC's support in innovation and commercialisation, while the second half of the book highlights the excellent research, innovation and transformation efforts of Singapore's public healthcare partners. The book also paves the future of NHIC's vision in advancing technology development and adoption at the systems-level, progressing from individual project-level support to facilitating national and international healthcare transformation.



NHIC has become a critical component of Singapore's healthcare innovation and transformation ecosystem over the past decade, facilitating the development of many projects into impactful and cost-effective healthcare solutions in Singapore.

With this foundation, more projects can be scaled to greater heights, within and beyond Singapore. By facilitating innovation and clinical adoption in local settings, homegrown healthtech talent and start-ups can leverage the standards and quality of Singapore's healthcare system, as they expand their inventions abroad. This strengthens the "Made in Singapore" brand and makes our companies globally competitive.

As I always say, "Singapore first, unicorn next".

As NHIC moves into the next few decades, we will continue to bring clinical innovations to bear, from bench to bedside to market, catalysing healthcare innovations and enhancing health and economic impact locally and globally.

Associate Professor Henry Ho
Executive Director
NHIC



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From helping to turn ideas into inventions, to facilitating clinical adoption, NHIC has provided extensive and critical support to deliver healthcare and economic impact. Read on to learn about some of its successes.





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Tapping on AI for more accurate spinal landmark identification





When artificial intelligence (AI) was just emerging from obscurity and gaining traction in the medical field, the Women's Anaesthesia team at KK Women's and Children's Hospital (KKH), led by Professor Sng Ban Leong, had an idea: Why not use it to help doctors perform spinal anaesthesia more accurately for women undergoing childbirth? Presently, doctors use their hands to feel for the right location on women's spines to insert the spinal needle.

"It takes an experienced hand to identify spinal landmarks, correct locations along the spine, for an injection, and this can be even more challenging in people with a high body mass index or abnormal spines," explains Prof Sng, Head and Senior Consultant of the Department of Women's Anaesthesia at KKH.

He thought about the possibility of using AI to analyse ultrasound images and identify the spot and angle at which the needle should be inserted into the spine. This would minimise the attempts required for a successful injection, even for less experienced

anaesthetists. As a clinician, however, he was unsure of how to turn his idea into a usable product, let alone one that was commercially viable. "My expertise did not lie in product development or regulatory compliance."

Unfazed by the challenges, the KKH team led by Prof Sng, reached out to the National University of Singapore's (NUS) Department of Electrical and Computer Engineering and NHIC. NHIC stepped in to assist by guiding and shaping his ideas through the clinician innovator pathway. Leveraging KKH's clinical expertise, NUS engineers came on board to develop an AI model.



The proposed solution presented a clear competitive advantage and could be integrated seamlessly into existing clinical workflows. In addition, it has the potential to serve a wide range of therapeutic and diagnostic purposes, including neuraxial anaesthesia, epidural labour analgesia and lumbar punctures.

With NHIC's Innovation to Develop (I2D) grant and support, the team was able to annotate ultrasound images to train the AI model in detecting spinal landmarks. The grant also allowed the engineers to further refine the software.

Prof Sng says: "Those were the critical building blocks of the AI system we have today, called uSINE®. With NHIC's support, we were then also able to conduct clinical trials."

Beyond providing financial support, the NHIC team was a critical bridge between the clinicians and engineers.

“ We brought complementary perspectives to the project. The clinical team made sure that the AI system could recognise the spinal structures in the images, while the engineers ensured the interface was user-friendly. NHIC helped us to find a balance between these perspectives during the product development. ”



“

The team at NHIC also took the time to explain technology terminologies that I was unfamiliar with, and ensured that we met timelines and resolved issues that would have otherwise led to delays. All of this was very important for us to deliver a medical product on time that is easy to use and works well. ”



PROFESSOR SNG BAN LEONG

Head and Senior Consultant

Department of Women's Anaesthesia
KK Women's and Children's Hospital (KKH)



NHIC's support for KKH also included facilitating the team's hiring of research coordinators to assist with administrative, recruitment and study protocol work.

After the I2D phase, uSINE® evolved with support and incubation at NUS Enterprise, leading to the founding of spin-off company, HiCura Medical, helmed by Dr Ng Cailin, Co-founder and Chief Executive Officer.

With uSINE®, KKH has raised the first attempt success rate of needle insertion for spinal anaesthesia, from about 70% to 92% in women with healthy weight, and from 43% to 82% in women with high body mass index. This avoids the need for repeated procedures and reduces the rate of complications and post-delivery trauma.



Some of the KK Women's and Children's Hospital (KKH) staff and HiCura Medical team members behind uSINE®
(From L to R): Dr Jason Chan, KKH, Mr Alex Goh and Dr Ng Cailin, HiCura Medical, Ms Agnes Teo, KKH, Mr Joshua Chen, HiCura Medical and Professor Sng Ban Leong, KKH.
Photo courtesy of KKH



DR CAILIN NG

Co-Founder and Chief Executive Officer
HiCura Medical

Through the Innovation to Adopt (I2Adopt) grant, NHIC is aiding Singapore's public healthcare clusters to implement and adopt uSINE® into clinical settings. In parallel, HiCura Medical is looking to conduct trials overseas.

Dr Ng highlights: "With NHIC's support, we've gained commercialisation opportunities, via showcases at events and access to potential investors and partners, and through active marketing."

“ As clinicians, we know what the unmet needs of patients are. Innovation is one way to bring better healthcare to patients, and NHIC is instrumental in empowering clinicians to translate ideas from research to commercialisation. ”



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*Photo courtesy of Yong Loo Lin School of Medicine,
National University of Singapore (NUS Medicine)*



From curing dogs with cancer to developing novel therapies for cancer treatment in human patients



There's a saying that dogs are man's best friend, and now they are aiding scientists in the fight against cancer. When Associate Professor Too Heng-Phon and his team at the Department of Biochemistry and NUS Centre for Cancer Research (N2CR), Yong Loo Lin School of Medicine, National University of Singapore (NUS Medicine), cured terminally ill dogs of their late-stage cancer, it marked a milestone in their research.



Their method modifies a type of adult stem cells, called mesenchymal stem cells, to seek out and destroy aggressive cancer cells. A/Prof Too says: **“Typically, viruses are used to introduce therapeutic genes into stem cells for targeted cancer treatment. However, this approach is costly and time-consuming, and viral vectors pose safety concerns.”**

The United States Food and Drug Administration (FDA) has advised that there should be fewer than five copies of such virus-altered cells inserted into each patient, since the cells could integrate into the patient's genome and cause unintended mutations. **“In contrast, our method, being non-viral, can safely introduce a higher payload of therapeutic genes into the stem cells.”**

As humans and dogs are genetically similar, the NUS Medicine breakthrough has great potential. **“Having proven that this therapy is safe and shows promising clinical benefits in canines, we hope to develop effective**

treatments to help people with cancer too, which can improve their health without compromising their quality of life.”

A/Prof Too says that the road to innovation is often challenging. **“Whenever you're venturing into something new, there are inherent obstacles. Few believed that our innovation would work.”** He adds that the way ahead, to bring the innovation to clinic and market, is also expected to be long. **“Conducting clinical trials involves numerous processes to ensure patient safety and efficacy and can span several years.”**

He set up a company called AGeM Bio Pte Ltd (AGeM Bio) in January 2024 to aid in the commercialisation phase of his innovation. While developing biotechnology products in Singapore has challenges – such as obtaining private capital and resources, talent attraction and retention, and meeting regulatory requirements – institutions such as NHIC have been supportive, he says.



“

There was a time when we lost our funding and were on the verge of giving up. I even considered giving our work away. NHIC stepped in at just the right moment and extended funding that allowed us to secure subsequent financing promptly. The team at NHIC also advised us on regulations and connected us with prospective partners. ”



ASSOCIATE PROFESSOR TOO HENG-PHON

Department of Biochemistry and NUS Centre for Cancer Research (N2CR),
Yong Loo Lin School of Medicine, National University of Singapore
(NUS Medicine)

*Photo courtesy of Agency for Science, Technology and Research (A*STAR).*



*Photo courtesy of Yong Loo Lin School of Medicine,
National University of Singapore (NUS Medicine)*

To help realise the potential of this innovative therapeutic platform to treat cancer and other conditions in a safer and targeted way, NHIC has continued to support A/Prof Too and his team. This includes providing strategic guidance on how to position the invention, and securing an incubator space for AGeM Bio, to expedite the team's progress to in-human trials and beyond. NHIC will continue to assist the start-up with talent and capability development.

“ It is difficult for researchers and start-up founders to look for sources of assistance by themselves. They would have to knock on many doors and face many rejections. NHIC, with its connections to the right stakeholders, expedites the search. ”



He adds that support, funding and expertise from institutions such as NHIC – alongside a strong culture of innovation – foster an ecosystem where local biotechnology trailblazers can thrive. This is crucial to advance Singapore's medical technology ecosystem.

Promoting such local innovation is also in line with Singapore's Research, Innovation and Enterprise (RIE) Plans, which endeavour to catalyse new growth sectors, raise the nation's

economic competitiveness, and generate scientific breakthroughs to meet national needs and improve Singaporeans' lives.

Furthermore, A/Prof Too believes that Singapore can play a leading part in guiding global biotechnology development. He explains: **"With our strategic location in Asia, good infrastructure, skilled workforce and other advantages, we have the capability to influence the field's future."**

NHIC's contribution to healthcare innovation goes beyond grant funding and administrative support. Its efforts span from ideation to implementation, encompassing project guidance, talent development and facilitating partnerships for success.



Gravitating towards a magnetic way to stimulate muscles for mobility and health

QUANTUMTX





For Ms Lee Choi Cheng, 68, this innovation has been life changing. After years of working long hours at a desk job that left little time for exercise, her weakened muscle strength led to several falls, including a severe one that dislocated her shoulder.

During the medical examination, it was discovered that her muscles were exceptionally weak, with her doctor describing her as “having virtually no muscles at all”. She became afraid of taking stairs and reliant on her husband to get up from seats, and eventually found herself confined at home.

Today, however, she has regained enough muscle strength to exercise and improve her health. What made the difference? A medical device invented by Associate Professor Alfredo Franco-Obregón, Department of Surgery, Yong Loo Lin School of Medicine, Institute

of Health Innovation & Technology (iHealthtech), National University of Singapore (NUS).

The machine, named BIXEPS, sends magnetic pulses through the leg to activate and strengthen muscles without the need for exercise. After a 12-week treatment programme at the centre, her muscle strength improved significantly, and she gradually regained her mobility. This renewed her confidence, compared to before when she completely relied on her husband as “her walking stick”.



"I can stand up from chairs now by myself and practise doing that 10 to 15 times a day to build up my strength. I'm able to go for walks with my husband and we hope to travel again this year," she says. Mr Glenn Johnson, 67, her husband who also participated in the programme, adds: **"In the past, I could only do 20 jumping jacks at a time. Now, I can do 50 or more and feel much healthier. BIXEPS has been a blessing for both of us."**

A/Prof Franco-Obregón was intrigued since his days as a student and marvelled at how technology could impact the lives of others, and hence, he developed BIXEPS. While the earlier idea for BIXEPS was to help astronauts regain muscle strength as that was

most likely to receive interest from international funding agencies, he always had larger ambitions. **"We want to help people who have difficulty exercising: the elderly, the frail, those undergoing chemotherapy and many more."**

After he moved from ETH Zurich to NUS to realise this goal, NHIC provided a crucial boost to his project with its Innovation to Develop (I2D) grant in 2015. NHIC saw its potential to positively impact a growing ageing population facing mobility issues. He shares: **"That gave us funding to make our first prototype, which put us in a good position to launch our start-up QuantumTX to push the BIXEPS technology and adoption forward."**



“

Apart from encouraging us to run user trials, NHIC also supported us holistically, such as by sharing advice on navigating regulations and supporting us in other ways. NHIC is a very valuable catalyst in Singapore's healthcare ecosystem. Even good ideas can get stuck on the laboratory bench. NHIC helps to bridge the difficult translation from the laboratory to the clinical side.”



ASSOCIATE PROFESSOR ALFREDO FRANCO-OBREGÓN

Department of Surgery, Yong Loo Lin School of Medicine
Institute of Health Innovation & Technology (iHealthtech),
National University of Singapore (NUS)



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MR IVAN GOH

Chief Executive Officer
QuantumTX



Mr Ivan Goh, QuantumTX's Chief Executive Officer, shares that apart from Singapore, the company is also conducting trials in Hong Kong and the United States to gather data on

its effectiveness for different cohorts, such as the elderly and stroke patients. Previous trials focused on younger participants with sports injuries and patients who underwent knee surgeries.

Presently, the results show that, among other benefits, BIXEPS increases functional mobility, alleviates pain, and reduces visceral fat, which is fat that surrounds the liver and other abdominal organs, decreasing risks of metabolic diseases.



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A novel and ingenious solution for acute acne



For Dr Goh Boon Chong and Professor Maurice van Steensel, putting on the hat of start-up founders in addition to their laboratory coats as long-time scientists has been a new, challenging, yet fulfilling experience for them. After years of success in the world of academia, they teamed up to establish and run their first start-up, ArrowBiome.

Their journey started when Dr Goh, a Principal Research Scientist at the Singapore-MIT Alliance for Research and Technology's (SMART) Antimicrobial Resistance Interdisciplinary Research Group (AMR IRG), began looking into

the potential of lysins, a type of enzyme that kills harmful bacteria in a fast yet selective manner, to tackle the global health threat of antimicrobial resistance.



As he furthered his research, colleagues suggested that he commercialise his work by using lysins to target acne. This line of development dovetailed with his desire to help his wife, who suffers from recurring acne. **“The struggles she faced inspired me to find a better way to treat and manage acne,”** he shares.

Following his colleagues’ advice, he reached out to Prof Maurice van Steensel, Professor of Dermatology and Skin Biology at Nanyang Technological University’s Lee Kong Chian School of Medicine. The two scientists hit it off immediately and decided to collaborate on executing the idea, but neither had experience in developing a product.

Prof van Steensel says: **“Entrepreneurship requires a different skillset from that of a scientist.**

Our team needed someone with a commercial mindset.” They later found a serial entrepreneur, who also runs a venture building firm, to join ArrowBiome as its business advisor.

Presently, ArrowBiome plans to supply lysins as active ingredients to industry partners for cosmetic product development within the next two years. How did they achieve this? Prof van Steensel shares: **“NHIC not only provided us with financial support via its Innovation to Develop (I2D) grant, but also linked us to experts such as regulatory consultants, to accelerate our pathway to commercialisation.”**

Having access to an ecosystem of support, which includes not only funding, but also expert advice, project guidance and other resources, made a world of difference to the ArrowBiome team.



“

The holistic support given by NHIC was instrumental in advancing the early stages of our company.”



PROFESSOR MAURICE VAN STEENSEL

Professor

Dermatology and Skin Biology, Lee Kong Chian School of Medicine Nanyang Technological University (NTU)

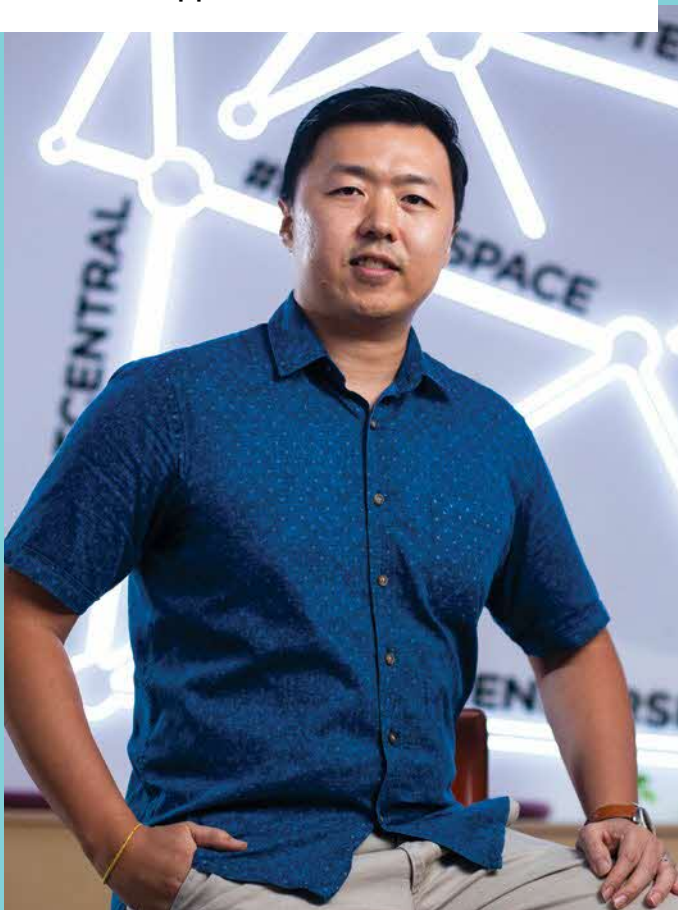
Research Director

Skin Research Institute of Singapore (SRIS),
Agency for Science, Technology and Research (A*STAR)



“

We want to get our first product out quickly, establish a good reputation and make our company viable, so that we can branch out into medical applications down the road. ”



DR GOH BOON CHONG

Chief Executive Officer
ArrowBiome



Dr Goh explains that while start-up founders face many difficulties, including fundraising, one of the earliest and most consequential decisions they must make is deciding on their beachhead market and business model. **"These decisions determine our business and research strategy moving forward."**

Initially, Dr Goh considered developing lysins as a therapeutic. However, after attending an innovation bootcamp, Dr Goh decided to pursue the cosmeceutical route, which led him to join forces with Prof van Steensel. The regulatory expertise brought in by NHIC confirmed the feasibility of pursuing this alternative market – developing lysins as a cosmetic ingredient, which shortens the time to market and reduces costs.

Prof van Steensel adds that NHIC's support has also helped with fundraising. **"NHIC is a national programme office with an extensive support network that inspires confidence in investors."** SMART and Enterprise Singapore have also assisted in the scientists' product development and business expansion through grants and programmes.

Both Dr Goh and Prof van Steensel highlight the need for a vibrant local biotechnology start-up ecosystem, with more appetite for risk-taking and funding for early-stage start-ups. As Prof van Steensel puts it: **"If you want unicorns and ground-breaking innovations to help people, you need critical mass. Nurturing more innovative biotech start-ups will increase the likelihood of ideas becoming successful tangible products."**



Leveraging data analytics to manage diabetes and other chronic diseases





How can a nation tap on the power of predictive analytics to make the leap to proactive care? Mesh Bio is helping to show the way, in Singapore and beyond. The healthtech start-up's software uses predictive analytics on medical data to identify patients at risk of chronic diseases and enable them to better manage their conditions.

The company, founded in Singapore, has expanded into Malaysia, Indonesia and the Philippines. In early 2024, it raised US\$3.5 million (S\$4.8 million) from venture capital (VC) firm East Ventures and other investors, including Elev8.vc, a deep-tech VC, and Seeds Capital, the investment arm of Enterprise Singapore. This brought its total funding to date to US\$5.3 million.

In Singapore, Mesh Bio's DARA health intelligence software analyses an individual's health and medical data to empower people to better manage their own health. Its Co-Founder and Chief Executive Officer Dr Andrew Wu explains: **"If a person is healthy, we can devise strategies to help maintain this. If the medical results indicate health trends that we should be concerned about, we can provide insights to assist doctors in developing targeted care plans."**



Andrew shared that his desire to bring about personalised care in communities is motivated partly by his mother's health issues. **"She suffered from hypertension for over a decade and eventually had a stroke. She was struggling to receive medical care that targeted her condition holistically. Her blood pressure was poorly controlled, and she became dizzy sometimes even before the stroke. That's why I want to use technology to enable more holistic and personalised care."**

He adds that by automating workflows through software, time spent on administrative tasks such as paperwork and chasing laboratories for test results can be significantly reduced. **"This allows healthcare providers to devote quality time to patient consultations and care delivery."**

In particular, one component of DARA, predicts the risk of type 2 diabetes patients developing chronic kidney disease. This innovation, approved by Singapore's Health Sciences Authority,

represents a transformative shift towards pre-emptive healthcare.

Unlike traditional blood and urine tests that can only detect a decline in kidney function after it occurs, HealthVector® Diabetes offers the opportunity for early intervention. **"With our invention, we have a much better chance of preventing chronic kidney disease from happening."**

Dr Wu notes that Mesh Bio's accomplishments to date have been supported by NHIC and other organisations. **"When developing a new technology, securing validation and regulatory approval is important, but it is equally important to ensure that the technology is accessible and affordable to clinicians and patients."** He explains that healthcare-related start-ups often face a significant challenge in bridging the gap of connecting with healthcare providers, to enable the adoption of new technologies into real-world clinical settings.



“

NHIC's I2Adopt grant was the bridge
that helped us cross that gap. ”



DR ANDREW WU

Co-Founder and Chief Executive Officer
Mesh Bio



Through the I2Adopt grant, HealthVector® Diabetes is being trialled in an implementation pilot at Tan Tock Seng Hospital, Singapore General Hospital and selected polyclinics for potential adoption.

NHIC's support in terms of resources and opportunities for startups to work with the clinical community, also helps to attract and reassure investors.

“ I think one of the reasons our recent fundraising was so successful is that NHIC's recognition of what we are trying to achieve sent a strong, positive signal to investors that they can trust us, ” Dr Wu says.



This fundraising prowess is in turn paving the way for Mesh Bio's overseas expansion.

To date, DARA, has been used by more than 120 medical centres across Singapore, Malaysia, Indonesia and the Philippines for preventative health screening. Mesh Bio's next big plans are to ramp up its commercialisation and market expansion plans in these three markets and enhance its products' roll-out and adoption in Singapore.

"Singapore is our nexus for launching new products. Given Singapore's reputation for high quality healthcare, gaining traction here can significantly strengthen our position to expand overseas. Local adoption instils confidence in regional healthcare providers, assuring them that our innovations are reliable, trustworthy and effective."



HOW DOES HEALTHVECTOR® DIABETES WORK?

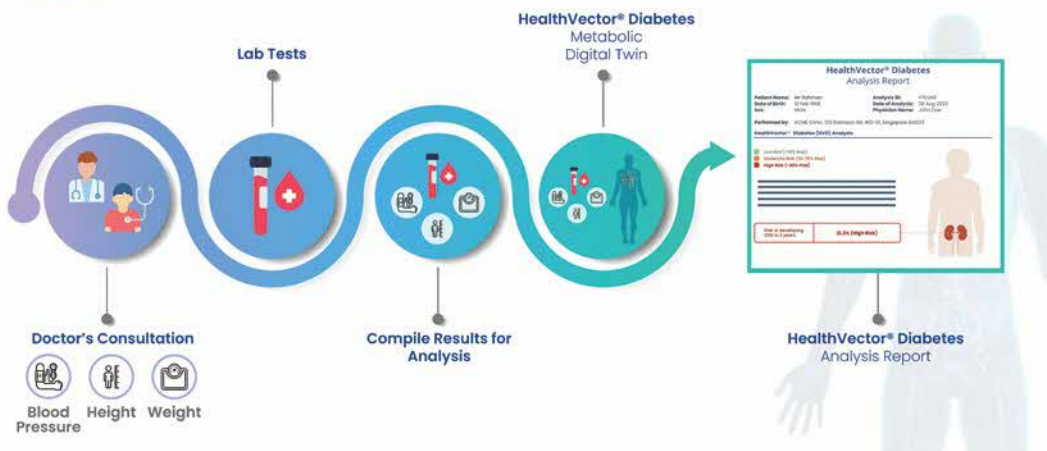


Photo courtesy of Mesh Bio



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CHAMPIONING SINGAPORE'S HEALTHCARE INNOVATION, ENTERPRISE DEVELOPMENT AND TRANSFORMATION

Singapore's three public healthcare clusters – National Healthcare Group (NHG), National University Health System (NUHS) and SingHealth – are leading innovation, enterprise and transformation efforts in their respective regions and communities. NHIC works with all clusters to synergise these efforts, accelerating the pace of translation and commercialisation.

With NHIC moving from project-level support towards enabling systems-level healthcare transformation, this provides more opportunities for collaboration with the public healthcare clusters to create and implement new innovations across the nation for better patient outcomes.



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Building an engine to drive innovation and enterprise





NHG's Centre for Medical Technologies and Innovations (CMTi) is the primary engine driving the cluster's wide-ranging innovation and enterprise initiatives. Aligned with NHG's vision of "Adding Years of Healthy Life", CMTi plays a crucial role in supporting clinicians on their innovation journey, in collaboration with research, academia and industry partners, to develop medical technology solutions that address unmet healthcare needs and contribute to better patient and healthcare outcomes.



Centre for
Medical Technologies
& Innovations

CMTi's mandate is to drive the end-to-end innovation and enterprise (I&E) ecosystem in NHG. The centre works closely alongside clinicians at every stage of innovation, supporting them in curating unmet clinical needs, and matching them with enterprising technology partners to translate ideas to commercialisable products. In this process, it collaborates with key partners such as NHIC, and the Agency for Science, Technology and Research's (A*STAR) Singapore Biodesign programme, to develop NHG's clinician-scientists and clinician-innovators through national-level funding and talent development programmes.

Through CMTi, NHIC has access to and can provide timely advice and guidance to the NHG teams who are developing new technologies. This is valuable in helping the project teams to move forward in developing their medical technology solutions towards commercialisation. This proactive approach not only helps NHG's clinicians refine their grant proposals but also enhances the quality of research and innovation within the ecosystem.



Photo courtesy of Good Pharma Dermatology

Further downstream, CMTi facilitates the commercialisation and adoption of new technologies by coordinating test-bedding, trials and new venture creation. The clinical and validation trial partners include the clinical trial units of NHG's hospitals, national specialty centres as well as business divisions, and the P.H Feng Research Centre. When the project is ready, CMTi may also involve other healthcare clusters for nationwide clinical trial and adoption. NHIC's Innovation to Adopt (I2Adopt) grant is pivotal in enabling such technology adoption efforts.

To date, CMTi has supported over 300 clinical innovators in project collaborations with industry partners, facilitated the initiation of 15 spin-off companies, and seen through more than 30 commercialised projects and more than 200 patents filed for NHG. These efforts have attracted more than \$40 million in direct industry funding through both cash and in-kind contributions.



The translational outcomes at NSC serves as a proof-of-concept of how leveraging research-innovation-entrepreneurship end-to-end can tangibly improve clinical outcomes and population health. These can be further upscaled to create a larger impact to benefit societies. ”



ASSOCIATE PROFESSOR TEY HONG LIANG

Clinical Director

Centre for MedTech & Innovations, National Healthcare Group (NHG)

Head of Research Division & Senior Consultant

National Skin Centre (NSC)

Associate Professor

Lee Kong Chian School of Medicine, Nanyang Technological University (NTU)

Photo Courtesy of National Healthcare Group (NHG)



NHG's National Skin Centre (NSC), which is Asia's only dedicated centre for dermatology, has built a formidable reputation for skin research and innovation. Its strong industry partnerships have resulted in many pioneering dermatological skin health solutions.

One such solution is BioRNA Antiscar, a first-of-its-kind dissolvable microneedle patch with proprietary RNA technology that reduces the appearance of scars. The patch is superior to silicone gel sheets, which is the current standard of care, in reducing post-surgical scars. The patch was developed by RNAscence Biotechnology, a spin-off company from NSC and Nanyang Technological University (NTU). It is currently sold in Singapore and many other countries.

Associate Professor Tey Hong Liang, Clinical Director of CMTi, Head of Research Division and Senior Consultant in NSC, and Associate Professor in Lee Kong Chian School of Medicine, NTU, was part of the founding team that developed the patch. He also formulated and launched Suu Balm in 2015, now a household name in sensitive skincare.

Suu Balm began with a pioneering dual-function body moisturiser uniquely designed to quickly alleviate itching while restoring the skin barrier. Over the years, the range has expanded to include skincare products for kids, body washes, facial care and a scalp series, all crafted with the same dedication to soothe and nourish sensitive skin. Beyond Singapore, Suu Balm has also expanded to more than 10 countries worldwide.



“NSC co-develops products that enable people to self-manage mild skin diseases and reduce their recurrences, and even prevent diseases from developing in the first place. An effective manner to empower population health is to make dermatological products that address common skin conditions accessible to the masses through commercialisation.”

He adds that CMTi is actively working with ecosystem partners to grow Singapore's healthcare innovation and enterprise ecosystem. For example, the NHG Open Innovation Challenge, jointly organised with Enterprise Singapore, has spun off two companies since its first edition in 2017.

In 2023, NHG, in partnership with NTU and A*STAR, launched co11ab@ Novena, a biomedical technology incubator located strategically within HealthCity Novena, to facilitate the commercial translation of technologies and entrepreneurial venture building.

A/Prof Tey notes that national-level support from agencies is critical in nurturing the development of medical technologies from seed to adoption, and an ecosystem of stakeholders working together synergistically is crucial in supporting initiatives that bring ideas to market.

“ Agencies such as NHIC provide support through funding of innovation and enterprise phases, facilitating networks among industry and other ecosystem stakeholders, and offering crucial guidance in entrepreneurship and commercialisation processes. ”



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Strengthening partnerships to benefit patients



Photo courtesy of SingHealth



In 2005, the SingHealth Duke-NUS Academic Medical Centre (AMC) was formed with the aim of harnessing the collective strengths of SingHealth's clinical expertise and Duke-NUS's medical education and research capabilities to enhance patient care.



The SingHealth Duke-NUS AMC fosters collaborations among their clinicians, healthcare professionals, researchers, scientists and faculty members to drive scientific endeavours, innovation, training as well as multi-disciplinary and cross-industry projects. To support this academic medicine journey, it has developed infrastructure,

such as multi-disciplinary centres and joint institutes, as well as various programmes.

A key example is SingHealth Duke-NUS AMC's 15 Academic Clinical Programmes that integrate clinical, research and education activities for each medical specialty in a holistic academic medicine ecosystem.



Photo courtesy of SingHealth

The SingHealth Duke-NUS AMC has also established 16 SingHealth Duke-NUS Disease Centres (SDDCs) to provide a strategic model of care for patients with specific conditions requiring multi-disciplinary teamwork amongst professionals from various disciplines and institutions. For instance, the SingHealth Duke-NUS Diabetes and Metabolic Centre hosts a multi-disciplinary team from various medical specialties to deliver more efficient and effective care for diabetic patients.

Additionally, the SingHealth Duke-NUS Joint Institutes represent another vital component in advancing this collaborative effort. For example, the

Academic Medicine Research Institute (AMRI) was created to consolidate core platforms and services like Intellectual Property protection and incubation, to facilitate and support research activities and translate outcomes. The Academic Medicine Innovation Institute (AMII) was also formed to provide guidance and support for budding innovators and foster a culture of innovation within the group. Other joint institutes include the Academic Medicine Education Institute, SingHealth Duke-NUS Global Health Institute and Institute of Patient Safety and Quality, to name a few.

Professor Thomas Coffman, Dean of Duke-NUS Medical School, highlights the importance of such collaborations in progressing healthcare. He notes:



“ Our AMC partnership enables us to drive impactful innovation as we seamlessly connect our scientific discoveries with the health needs of our patients and communities. By focusing on translational scientific research that addresses Singapore’s most pressing healthcare issues, we aim to improve the quality of life for people here and around the world. ”

Professor Lim Soon Thye, SingHealth’s Deputy Group Chief Executive Officer (Research, Education and Innovation), adds: “The SingHealth Duke-NUS AMC integrates world-class clinical expertise with cutting-edge research and education. This unique synergy enables us to pioneer medical advancements and develop innovative treatments. Our commitment to placing patients at the centre of our efforts ensures that our work consistently leads to improved healthcare outcomes, and sets us apart as a preferred partner for global collaborators.”

One notable success story of SingHealth Duke-NUS AMC is the spin-off of a biotechnology firm, Enleofen Bio. The company is developing a first-in-class treatment for fibrotic diseases. These are diseases that cause scars to form in organs such as the lungs, heart or liver, which can lead to heart and kidney failure and other serious consequences. The treatment has the potential to be life-changing for hundreds of millions of people worldwide suffering from fibrotic diseases. In 2020, global pharmaceutical company Boehringer Ingelheim signed a deal with Enleofen Bio, and clinical trials began in 2023.



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PROFESSOR THOMAS COFFMAN

Dean

Duke-NUS Medical School

Photo courtesy of Duke-NUS Medical School, Singapore



Photo courtesy of SingHealth

The SingHealth Duke-NUS AMC is also leading a five-year, multi-institution “Tackling and Reducing Glaucoma Blindness with Emerging Technologies (TARGET)” research programme to reduce the rate of blindness caused by glaucoma in Singapore in the next 10 years.

The programme has five prongs: genetic research to understand how alterations in critical proteins can worsen glaucoma; a study on how nicotinamide oral supplements can help delay glaucoma progression; and developing new technologies to screen undiagnosed glaucoma and monitor the disease in the community; predict which patients will go blind from glaucoma and how fast this will occur; and solve patients’ poor adherence to glaucoma medication.

With over 110 million people worldwide expected to have glaucoma by 2040, and nearly 20% of such patients losing their sight, the TARGET programme’s

work will benefit eye health not just in Singapore but also internationally.

Apart from this, SingHealth is improving population health outcomes through its collaborators on the “Community Ageing in Place Ecosystem (CAPE)” project, which aims to bolster community health services and social assets so that seniors can live and age well in their neighbourhoods.

Initially benefiting up to 920 seniors in Marine Parade and Bedok South, two of Singapore’s oldest estates, CAPE will assess its impact on improving seniors’ health-related quality of life, slowing age-related frailty, and reducing healthcare utilisation. The lessons learned will guide the project’s expansion to other areas, with a vision to reach at least 10,000 elderly residents in Singapore’s eastern region.

Together, the SingHealth Duke-NUS AMC and NHIC can power impactful healthcare innovations for Singapore.



A holistic model for healthy and purposeful living across all ages

As NHIC continues to support healthcare innovation, Singapore continues to invest in all the determinants of health. In Singapore's southwest, the Health District @ Queenstown initiative is turning the estate into a dynamic environment for piloting interventions aimed at systems, technologies and community efforts to boost residents' well-being across their life stages.



Photo courtesy of National University Health System (NUHS)



Professor John Eu-Li Wong, Executive Director of the NUS Centre for Population Health and Senior Advisor at NUHS, is co-leading the programme. He explains that recent comprehensive reports have shown that, with community-wide support, people can lead vibrant and healthy lives well into their golden years.

The reports include the World Health Organization (WHO) Decade of Healthy Ageing Baseline Report, and the United States National Academy of Medicine's Global Roadmap for Healthy Longevity report, which Prof Wong oversaw as Co-Chair of the international commission that produced it.

He emphasises: **"Hospitals should be the last line of defence. Health – the state of complete physical, mental and social well-being, and not merely the absence of disease or infirmity – is influenced by almost every sector, from housing to transport, education, employment and more. This is why the Health District @ Queenstown involves multiple disciplines, from social sciences to engineering, design, computing, biological sciences and health sciences, to develop a scalable model for Singapore. Promoting health must be a whole-of-society effort."**

"Since Singapore's independence, life expectancy in the country has increased by approximately 19 years," he adds.

“ If we can keep our population healthy, robust, and meaningfully engaged into their 80s and even 90s, we can turn this longevity dividend into a powerful asset for our nation. ”

Led by NUHS, NUS and the Housing and Development Board (HDB), together with multiple stakeholders from the public, private and people sectors, the goal is for the pilot Health District @ Queenstown to be a model of a healthy and active community for all ages. This involves building an environment that encourages healthy habits for long lives, enables purposeful longevity, promotes intergenerational bonding, and empowers residents to be independent and age in place.

Queenstown was selected as the pilot site for the programme as its demographics closely mirror Singapore's projected national demographics by 2030. "In Queenstown, we are looking at Singapore's future. Of its population of 100,000 residents, about 22% are over 65 years old, 80% live in HDB flats, and its ethnic profile of Chinese, Malay, Indian and other communities are representative of Singapore," points out Prof Wong.



As Singapore's population ages, the whole of Singapore is going to look like Queenstown by 2030. If we can move the needle for Queenstown's 100,000 people, we can do so for Singapore's 5.9 million residents. ”



PROFESSOR JOHN EU-LI WONG

Executive Director

Centre for Population Health, National University of Singapore (NUS)

Senior Advisor

National University Health System (NUHS)

Photo courtesy of National University Hospital Systems



To encourage purposeful longevity and intergenerational bonding, Health District @ Queenstown has started the first 'Ibasho' project in Singapore, taking inspiration from a Japanese concept that refers to a place where everyone can feel they belong. Queenstown residents, including older adults with their experience and expertise, are working hand in hand to develop an active ageing centre together.

The district is also piloting an embedded shared-care team approach, with healthcare and social services partnering to check on residents' well-being and create personalised care plans. For example, if the team identifies an eligible resident who has not undergone the Ministry of Health's recommended chronic disease screening in the appropriate time frame, or has poorly controlled chronic disease, it will examine the reasons behind this and address them. A significant number of cases are expected to be due to both medical and social factors, necessitating a combined, coordinated approach to find solutions.

Apart from community programmes, infrastructure is also critical given its significant impact on health. There are plans to include amenities that promote active lifestyles, such as a fitness trail and new cycling paths, as well as wellness landscapes and therapeutic gardens for relaxation. A Social and Wellness Hub will house

facilities for communal activities and healthcare services, while Community Care Apartments will come equipped with senior-friendly fittings, such as grab bars and wheelchair-accessible bathrooms with slip-resistant flooring. Additionally, Community Care Apartments are paired with essential services where residents will subscribe to a Basic Service Package, which includes services such as 24-hour emergency monitoring and response, and basic health checks. To promote mobility within the neighbourhood, features such as barrier-free access ramps and wider centre dividers for roads will also be introduced in more areas.

Researchers, HDB and residents are working together to identify and test useful, scalable, financially sustainable and resource-efficient solutions for adoption on a larger scale. One technology making the leap is an in-home fall detection system that uses sensors to monitor movement and will alert caregivers if someone has fallen and needs help. After trials were done in Queenstown, residents can now apply for the fall detection systems offered commercially from this year.

As NHIC moves from championing individual projects to providing systems-level support, it aims to partner more organisations such as NUHS, NUS and HDB in rolling out Health District @ Queenstown's innovations across Singapore to benefit all.



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Transforming primary care with the use of telehealth for chronic disease management



Photo courtesy of National Healthcare Group Polyclinics



As Singapore makes breakthroughs in community healthcare, innovation capabilities and cross-disciplinary collaboration, it is also investing in systems-level innovations with profound national impact. Launched in 2018 by the MOH Office for Healthcare Transformation (MOHT), the Primary Tech-Enhanced Care (PTEC) initiative empowers patients to self-manage chronic diseases with the help of their primary care providers.

MOHT

MOH OFFICE FOR
HEALTHCARE TRANSFORMATION

PTEC began in partnership with National Healthcare Group Polyclinics, with the Home Blood Pressure (BP) Monitoring Programme that trialled the use of a home monitoring kit for hypertensive patients.

The pilot was met with success, with patients showing better clinical outcomes, such as better controlled blood pressure. They also reported satisfaction with, and gave positive feedback on, the programme. PTEC is now available in all polyclinics across Singapore. This is the result of MOHT, Synapse and polyclinic clusters coming together to improve patient outcomes by integrating high-impact technologies in primary care settings.

Through the nationwide roll-out of the Home BP Monitoring Programme,

PTEC has made a difference in the management of hypertension, one of Singapore's most common chronic diseases. Eligible patients can sign up for the programme through their nearest polyclinic, download an app and use a blood pressure monitor at home to measure their blood pressure at least once a week.

Their readings are monitored by the polyclinic care team via a dashboard that surfaces only cases that require their intervention. The app flags abnormal readings to the care team so they can provide timely guidance and advice through teleconsultations if needed. The app also notifies patients on what they should do if their readings are not normal, reminds them to take readings and medication, and sends encouraging messages and tips.



To date, more than 15,000 patients have joined the programme through all 26 polyclinics in Singapore. About half of the participants showed improved control of their blood pressure after six months and maintained this for 12 months after being on PTEC. With over one third of Singapore residents aged between 18 to 74 years suffering from high blood pressure, which can lead to strokes and other problems, such improvements can be transformative.

Professor Gerald Koh, Head (Future Primary Care) and Clinical Director, MOHT, gives the example of a patient in the Home BP Monitoring Programme whose low blood pressure reading prompted a call from a nurse. He recounts that during the conversation with his nurse, the patient suddenly felt giddy, and his wife had to assist him to his bed. The nurse immediately advised his wife to call for an ambulance, as his condition could escalate into a more serious problem such as a stroke or heart attack.

Says Prof Koh: **"The patient said that this intervention ended up saving his life."** He adds that the patient was grateful and recommended that the monitoring programme be actively introduced to the public.

Following the good outcomes from the Home BP Monitoring Programme, PTEC has been expanded to include diabetes, with a similar Home Diabetes Monitoring Programme having been trialled in four polyclinics with 300 patients.

Prof Koh highlights: **"Clinicians have responded positively to this programme. They have shared that, by being able to monitor their patients' blood sugar readings, they are able to better manage the patients' condition, for example by adjusting the medication as needed."**

He adds that such home monitoring programmes will become more important as Singapore faces an increasing burden from chronic diseases due to its ageing population. **"These diseases are primarily managed in care settings such as polyclinics and by general practitioners."**

"By using these integrated care delivery systems, we can empower patients to manage their conditions independently, while building a trusted relationship with their primary care providers."

Using the same principle, PTEC may be applicable to monitoring asthma, depression and other conditions. Says Prof Koh: **"Like diabetes mellitus and hypertension, remote clinical monitoring of asthma and depression may potentially enable better management of these conditions without the need for face-to-face visits."**

Innovative solutions such as PTEC are made possible when the ecosystem is united, Prof Koh affirms.



“

Every part of the healthcare system, from researchers, clinicians and technology developers to care providers and patients themselves, can contribute to innovation, and we must all work together to learn faster, speed up adoption, and turn advances into standards of care. ”



PROFESSOR GERALD KOH

Head (Future Primary Care) and Clinical Director
MOH Office for Healthcare Transformation (MOHT)

Photo courtesy of MOH Office for Healthcare Transformation (MOHT)



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As Singapore looks to the future, it must manage increasing healthcare challenges, including its ageing population's growing healthcare needs and the complexity and cost of meeting them. There are several national clinical translational programmes, such as Precision Health Research, Singapore (PRECISE), Cardiovascular Disease National Collaborative Enterprise (CADENCE) and Singapore Translational Cancer Consortium (STCC), established to drive clinical application and commercialisation by combining basic research and clinical and translational strengths across Singapore and institutions in a synergistic and integrated manner.



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78 New Horizons
in Healthcare

CRIS

Consortium for Clinical Research and Innovation Singapore



YOUR PARTNERS IN
RESEARCH, INNOVATION AND TRANSLATION





New Horizons in Healthcare

These programmes are housed under the Consortium for Clinical Research and Innovation, Singapore (CRIS) umbrella together with NHIC, amongst others. The workstreams undertaken by these three programmes are highlighted:



DR SEOW SHIH WEE

Director (Corporate Services)

Precision Health Research,
Singapore (PRECISE)



DR MICHAL MAREK HOPPE

Data Analyst

Singapore Translational Cancer
Consortium (STCC)



PROFESSOR ANDY HO

Joint-Lead

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School of Social Sciences

Professor

Lee Kong Chian School of Medicine

Director of Research

Palliative Care Centre
for Excellence in Research and Education
(PaLIC) Founding

Director

Action Research for Community
Health (ARCH) Laboratory,
Nanyang Technological University (NTU)



ASSOCIATE PROFESSOR DOREEN TAN

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Disease National Collaborative Enterprise
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Associate Professor

Clinical Pharmacy and Pharmacy Practice
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National University of Singapore (NUS)

Cardiology Specialist Pharmacist

National University Heart Centre,
Singapore (NUHCS)



The National Precision Medicine (NPM) programme was set up to provide deeper insights into Asian health, enhance disease prevention and improve patient outcomes. Now in Phase II, **PRECISE** and its SG100K partners are sequencing the genomes of 100,000 consented Singaporeans to study their genetic make-up as well as lifestyle and environmental factors which affect Asian health, paving the way for data-driven, personalised healthcare solutions and better patient outcomes.

Hence, PRECISE is partnering clinicians to carry out clinical implementation pilot projects, to study the implementation of precision medicine approaches into clinical workflows, and find ways to translate research findings from the PRECISE-SG100K cohort into interventions that lead to improved health outcomes.

“With precision medicine, we can be more specific with treatment, reducing drug allergies and other negative side effects. By finding underlying causative agents of medical conditions, we can also implement earlier screenings for preventive care and improve patient health outcomes,” says Dr Seow Shih Wee, Director of Corporate Services, PRECISE.



As **CADENCE** works towards enhancing research and treatment efforts in cardiovascular disease (CVD), digital health technologies such as mobile apps, paired with human coaching solutions, can empower patients to better manage their chronic conditions, decentralise care and ultimately reduce healthcare costs.

CADENCE's AI, Digital Health, and Human Potential Platform is working to implement a digital tool that functions like a health coach to supplement the efforts of clinicians and pharmacists to improve medication adherence and motivate patients with high cholesterol to adopt healthier lifestyle practices and reduce their risk of CVD in the long run.

Presently, the digital tool is being test-bedded in a clinical trial, led by Associate Professor Doreen Tan at the National University of Singapore. A/Prof Tan shares, **"People do not take their medication for many different reasons, so by identifying the cause through this digital tool, we can gather insights**

to understand our patients better, and tailor more targeted support and interventions for them."

"I have always believed in man-machine synergy. Computers and artificial intelligence work around the clock and can complement clinicians, so the latter can focus on clinical decisions and quality patient care, while patients can learn new ways to manage their conditions. I have high hopes that this will boost medication adherence and improve patient outcomes," says Nanyang Technological University A/Prof Andy Ho, one of the joint leads of the project.



To synergise cancer research capabilities and raise Singapore's competitiveness and healthcare impact, the **STCC** is accelerating translational research through five joint platforms which serve to enable collaboration and explore novel approaches to deliver high-impact healthcare outcomes.

Presently, STCC's Translational Research Integration and Support platform is leading a multi-institutional study that spans eight other local public institutions, including hospitals and research institutes.

By profiling tissue samples from 200 cancer patients, the SUPER study, short for STCC Unified PD1/PDL1 Evaluation of Response, aims to find genetic biomarkers to help clinicians predict which patients will respond to immune checkpoint inhibitors that boost the immune system's ability to kill cancer cells. This aims to help

guide clinicians towards the use of more effective treatment choices.

Dr Michal Marek Hoppe, Data Analyst at STCC, adds that the findings could lead to more fruitful partnerships. He explains:

"We could work with NHIC and other organisations to turn clinically useful findings into diagnostic kits and other projects to enhance patient care in cancer diagnosis, delivery and healthcare management."



NHIC IN THE NEXT PHASE

As these multi-disciplinary national clinical translational programmes under CRIS march forward, advancing human health and potential and bringing better healthcare to Singapore and Singaporeans, NHIC plays an important role in synergising with sister programmes – **PRECISE**, **CADENCE** and **STCC** – to accelerate the translation and implementation of clinical innovations into health and economic outcomes. NHIC is expanding its focus from innovation and enterprise to clinical adoption, to support national healthcare priorities, delivering better care to patients and individuals.



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INNOVATION

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NEW HORIZONS IN HEALTHCARE

“ As Singapore shifts towards more preventive and decentralised care, NHIC is evolving its support to the health innovation ecosystem, from providing project-level support to enabling systems-level healthcare transformation. ”

Associate Professor Henry Ho
Executive Director
NHIC



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Associate Professor Henry Ho

Executive Director
NHIC



AFTERWORD

Through the years, NHIC has helped to bolster Singapore's healthcare innovation ecosystem. Its work to date is made possible with the contributions of many partners and stakeholders.

As we mark NHIC's 10th year of supporting the healthcare ecosystem, I humbly take this opportunity to thank the National Research Foundation, Ministry of Health, National Medical Research Council and MOH Holdings for your support.



To all our partners, especially the National Healthcare Group, National University Health System and SingHealth, particularly their research, innovation and enterprise offices, thank you for your unwavering support and working alongside us.

Singapore's healthcare sector is undergoing exceptional transformation, demographic shifts and evolving patient needs, and is shifting towards more preventive and decentralised care. Accomplishing this healthcare transformation will require not just breakthrough tools, medical devices and technology, but

also healthcare systems which are interlinked and integrated. Innovation must be followed through with systems integration to achieve long-term and sustainable benefits for Singapore and Singaporeans.

This delicate yet necessary process is why NHIC's work in supporting the innovation, development, commercialisation and adoption of healthcare breakthroughs remains vital. It is also why NHIC is evolving its support of the healthcare innovation ecosystem, from providing project-level support to enabling systems-level healthcare transformation.



As NHIC moves into its next decade and beyond, it will build on its experiences to date. It will also expand its network of private sector and international partners, working more closely with them to guide innovation and translation towards directions that will meet Singapore's and global healthcare needs simultaneously, contributing to global economic impact and returns.

This includes supporting technological development, clinical workflow integration and stakeholder partnerships to enable systems for rollout and implementation.

NHIC has progressed and evolved to better support and catalyse Singapore's healthcare innovation ecosystem.

We will continue to push innovation boundaries, to contribute to Singapore's healthcare and economic transformation.

We invite you to join us on this journey to serve Singapore's present, emerging and future healthcare needs.

Associate Professor Henry Ho
Executive Director
NHIC



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