CHAPTER

06

THOUGHTS ON THE FUTURE STATE

FIRST STEPS IN POPULATION HEALTH

ASSOCIATE PROFESSOR TAI HWEI YEE, GROUP CHIEF QUALITY OFFICER, NHG

Right from the inception of NHG as a new healthcare cluster in 1999, population health was on the minds of its Senior Management. I recall the first NHG Strategic Retreat in Sentosa then, together with about 30 to 40 other senior clinicians and administrators from the entities that were to make up the new NHG cluster. As a group, we crafted the Vision, Mission Statement, and Core Values for this new entity. Our facilitator had challenged us to look beyond the mundane familiar statements and to really think deeply on what, as healthcare providers, we had really wanted to create for the future. From this retreat, our NHG Vision "Adding Years of Healthy Lives" to the Population of Singapore was born. Little did we know then that this Vision would eventually come to embody our aspirations as a group of diverse healthcare organisations to achieve what we know today as the "**Triple Aim**" for population health. Many international experts visited, shared, and interacted with us over the years including Dr Donald Berwick, President Emeritus and Senior Fellow, Institute for Healthcare Improvement (IHI); Professor Lucian Leape, Physician and Professor at Harvard School of Public Health; and Mr Goran Henriks, Chair Emeritus, International Forum Programme Advisory Committee and Chief Executive of Learning and Innovation, Jönköping County Council, Sweden, have commented how apt our Vision is in guiding our organisation in its quest for better population health.

"Triple Aim", as a concept, was publicly articulated by IHI's Dr Berwick at a National Forum in 2007. But this has evolved over many years, with thinkers such as Mr Thomas Nolan and Dr John Whittington. The main focus of the concept, was to not only look at healthcare from the perspective of improving care for an individual patient, but also to view it from the "widest possible lens" for outcomes that would impact the entire population. A challenging paradox was having to address, not just clinical outcomes, but also the cost of providing care and creating the best possible experience that care renders simultaneously.

In June 2009, a small group of four NHG leaders attended a gathering in London of 19 organisations that had come together to learn how to implement strategies and action plans to achieve "Triple Aim" as a large scale strategy within a country or for a region. Among the 19 organisations, eight had already started work on five key design concepts, and they included the UK, Scotland, and County Jönköping, Sweden. The five key concepts were:

1. **Focus on Care for Individuals and their Families**
   a. For medically and socially complex patients, establish partnerships among individuals, families, and caregivers, including identifying a family member or friend who will be supported and developed to coordinate services among multiple providers of care.
   b. Jointly plan and customise care at the level of the individual.
   c. Actively learn from the patient and family to inform work for the population.
   d. Enable individuals and families to better manage their own health.

2. **Redesign Primary Care Services and Structures**
   a. Have a team for basic services that can deliver at least 70 per cent of the necessary medical and health-related social services to the population.
   b. Deliberately build an access platform for maximum flexibility to provide customised healthcare for the needs of patients, families, and providers.
   c. Cooperate and coordinate with other specialties, hospitals, and community services related to health.

3. **Prevention and Health Promotion**
   a. Work with the community to advocate and provide incentives for smoking prevention, healthy eating, exercise, and reduction of substance abuse.
   b. Develop multi-sector partnerships, utilise key stakeholder resources (worksites, schools, etc), and align policies to provide community-based support for all who wish to make health-related behaviour change.
   c. Integrate healthcare and publicly available community-level data utilising Geographic Information System (GIS) mapping to understand the local context to strategically determine where and for whom health-related community-level prevention, health promotion, and disease-management support interventions would be most useful.

4. **Cost Control Platform**
   a. Achieve less than three per cent inflation yearly for per capita cost by developing cooperative relationships with physician groups and other healthcare organisations committed to reduce waste of healthcare resources.
   b. Achieve lowest decile performance in the Dartmouth Atlas measures by breaking or countering incentives for supply-driven care.
   c. Reward healthcare providers, hospitals, and healthcare systems for their contribution in producing better health for the population, and not just producing more healthcare.
   d. Orient care over time - the "patient journey" - targeted to the best feasible outcomes.

5. **Creating New Structures and Systems to Design and Implement Changes across Entities, Cost Control Platform, and System Integration and Execution**
   a. Match capacity and demand for healthcare and social services across suppliers.
   b. Ensure that strategic planning and execution with all suppliers including hospitals and physician practices are informed by the needs of the population.
   c. Develop a system for on-going learning and improvement.
   d. Institute a sustainable governance and financial structure for the "Triple Aim" system.
   e. Efficiently customise services based on appropriate segmentation of the population.
   f. Use predictive models and health risk assessments that take into account situational factors, medical history, and prior resource utilisation to deploy resources to high-risk individuals.
   g. Set and execute strategic initiatives related to reducing inequitable variation in outcomes or undesirable variation in clinical practice.

In addition, we learnt how important and challenging it was to measure progress to achieve the "Triple Aim" at the population-level. Mr Henriks and Mr Nolan shared how the Vision could be best supported by building a robust learning system through developing explicit theories for system changes and then testing changes sequentially. They introduced the concept of "**Act on the Individual and Learn for the Population**". The "Esther project" was an illustration of that concept.

From that early initiation to the current work of population health, NHG has gleaned many valuable lessons from this international community of experts and organisations, and adapted many initiatives into our own systems and structures. Besides that, we have also continued to be a part of this learning community, contributing the lessons learned from our own local experimentation of population health. At the International Forum of Quality and Safety in Healthcare in September 2018 in Melbourne, Australia, Professor Philip Choo, Group CEO, NHG, shared our "River of Life" concept with the audience. We are truly part of the international community where "**All Teach, All Learn**" is a philosophy that sustains the passion for improving and "**Adding Years of Healthy Life**" for our patients, our community, and our population.

BRIDGING LABORATORY AND LIFE FOR EFFECTIVE POPULATION HEALTH MANAGEMENT

PROFESSOR LIM TOCK HAN, DEPUTY GROUP CEO (EDUCATION AND RESEARCH), NHG

The beginning of all human civilisation can be traced back to a river or a lake, with water being a source of life. A healthy river system – one that is robust and sustainable – is vital for the continuation of life on earth. This is similar to the role of our healthcare system: an ecosystem that sustains rather than depletes its resources, rich in both quality and innovation, and fluid in adapting to new technology. This can only be achieved if we shift the paradigm: from 'sick' care to 'health' care.

Singaporeans now enjoy one of the highest life expectancies in the world. In the past three decades, our life expectancy has increased by almost 10 years. Yet, with every year of increased longevity, we see only two-thirds of an increase in Healthy Life Expectancy (HALE) – a measure of the quality of these additional years. We need to bridge this gap.

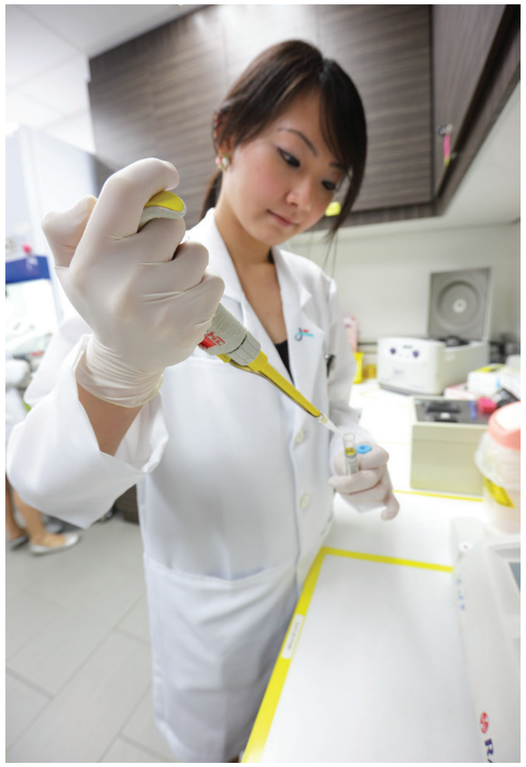
Traditionally, medical research and education focused on treating diseases when they occur, rather than **prevention and maintenance of health**. Now, we are increasingly shifting our academic pursuits upstream to support population health management for more value-driven outcomes.

To understand how to run an effective population health management system is to first understand the "nuts and bolts" that make up the complex healthcare system. Research analyses how the various healthcare determinants weave together, and the gaps of the current system that prevent it from reaching its ultimate potential or goal, which is to cure humanely, to relieve, to care, and to prevent, where possible.

This is where epidemiology research comes in. We can only begin to build the infrastructure of a population health management system if we have enough raw materials to study and work with. Carefully collected and diverse data is needed to study the trajectory of diseases, their causes, and previously unknown risk factors, in order to identify the sub-populations at risk, and eventually design evidence-based preventive strategies and practical interventions. The on-going Health for Life in Singapore (HELIOS) Study serves this purpose. Established and led by Nanyang Technological University (NTU)/Lee Kong Chian School of Medicine (LKCMedicine), in partnership with NHG and Imperial College London (ICL), the Study aims to mine a wide breadth of data from 10,000 Singaporeans/Permanent Residents to better predict, prevent, and manage chronic diseases. HELIOS, which is the first large-scale longitudinal health study done on Asians, will be a formidable databank for global scientists and doctors deepen their medical research.

This is but the first step. Generating impressive data and research studies will amount to little without tangible outcomes. These resources should be translated into novel applications for clinical practice and in turn, improve patient care and safety. NHG bridges this divide by developing a strong pipeline of Clinician Scientists, who serve as conduits between laboratory and clinical research. Together with NHG's primary clinical training partner, LKCMedicine, we have jointly developed a comprehensive research career development roadmap for our Clinician Scientists. They will help enhance NHG's research in niche areas such as metabolic diseases, including diabetes, infectious diseases, skin disorders, mental health, geriatrics, and healthy lifestyle.

In tandem, medical education is expanding its horizons to incorporate not just clinical knowledge, but a holistic



understanding of the healthcare system. Healthcare professionals will be trained in knowledge management, evidence synthesis, and in optimising the clinical network to provide value-driven and cost-effective care for patients. Besides practising at the top of their licences, healthcare professionals should embrace improvement sciences to ensure that care delivery stays ahead of the curve. A more comprehensive training programme will ensure that best practices consistently permeate the workplace among both healthcare professionals and administrative staff. Towards this end, NHG College has introduced a series of faculty development programmes to build and strengthen the capabilities of our educators. These programmes include the Health Professions Educators' Essentials (HaPEE) which is tailored to our local context, study trips made to global organisations to learn best practices, and regular faculty development workshops for staff.

As compared to formulating treatment plans for the sick, devising healthcare interventions for population health requires us to see things through wider lens. Sociology, behavioural sciences, health economics, and medical technology are just as important as systems biology in providing us with new insights. We are therefore investing in the creativity and energy of our younger generation. NHG is in a multi-party collaboration with tertiary education institutions in Singapore to develop gaming prototypes to address challenges in healthcare and to empower self-care in patients. Termed the 'ALIVE-POLY-ITE Student Internship Programme', the gAmes for heaLth InnoVations centrE (ALIVE), a collabration between NHG and LKCMedicine, will provide professional healthcare expertise to students in developing serious games prototypes that may translate into user-friendly solutions for better health outcomes and population wellness.

These key factors – exhaustive research, a fine-tuned education programme, and a relentless drive for improvement and innovation – will fortify the population health management infrastructure, and in turn lay the foundation for NHG to eventually become the Academic Health System (AHS) we aspire to be. Together with NTU, LKCMedicine, and ICL, we are working towards developing a population-centred AHS with our newly formed Joint Strategic and Implementation Committee (JSIC). This Committee brings together Clinicians and Academia to design, evaluate, and implement initiatives promoting population health.

The best designed system will only work if its people believe in its purpose. In this regard, we need to continually foster a culture that encourages curiosity, eagerness to learn, an openness to change, and most importantly, a heart for the patient. Only then, will we be able to establish an ecosystem of health that is able to add many more healthy years to our River of Life.

TRANSFORMING PRIMARY CARE: A FUTURE STATE WISHLIST

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

Primary Care Vision 2025: A world-class, relationship-based Primary Care ecosystem. This is the future of Primary Care in the Central Region as envisioned by National Healthcare Group Polyclinics (NHGP) in early 2015 when we asked ourselves what we would like to move towards to and build over the next decade. Five strategic objectives were identified:

1. New Care Delivery Model

Since then, NHGP has remodelled the way it delivers care across all its polyclinics. Its patient empanelment teamlet care model has brought about improved clinical outcomes, reduced diabetes and hypertension-related emergency visits, and increased patients' uptake of primary and secondary preventive health screening.

2. Expansion of Primary Care Capacity

Over the past four years, NHGP has also established patient right-siting collaborations with General Practitioners (GPs), and successfully handed over three Family Medicine Clinics (FMCs) set up with selected GP partners while continuing to jointly oversee the clinics' clinical governance. In line with the Ministry of Health's (MOH) support of GPs to deliver holistic chronic care through the Primary Care Networks (PCNs), NHGP is leading the Central-North PCN. Some 30 GP clinics now work closely with NHGP and NHG Institutions through this network to serve residents in the Northern and Central regions of Singapore.

3. Patient Engagement and Activation

To truly engage and activate our patients, we recognise the importance of developing a health literate workforce as an essential first step since our staff can be our health ambassadors. NHGP seeks to understand the gaps, identify ways and has put in place training to raise health literacy among all levels of staff.

4. Staff Engagement and Development
5. Stewardship and Setting Standards

As NHGP transforms Primary Care, it is important to ensure that our people are committed to the highest standards of ethical conduct, and exercise collective responsibility for the resources to provide care to our patients and the population. There are staff development projects such as job redesign for operations staff and training on how to work better as teamlets. We have also continued to improve the quality of our care and service delivery.

THE FUTURE AHEAD

In 2017, Health Minister Mr Gan Kim Yong shared MOH's Three Beyonds strategy – *Beyond Hospital to Community*, *Beyond Healthcare to Health*, and *Beyond Quality to Value* – for a sustainable healthcare system. This strategy further bolsters our Primary Care Vision 2025, by bringing the axis of care to the primary and community levels, and closer to the patient and population. The push for our Primary Care Transformation is gaining impetus as we continue to build on our Vision of a world-class, relationship-based Primary Care ecosystem for the Central Region of Singapore. This ecosystem, comprising NHGP and GPs in our region, is underpinned by a strong spirit of cooperation and knowledge-sharing, enabled by supportive funding, technological and physical infrastructure.

In late 2018, we reviewed and updated our strategic approaches to ensure that we are on track to achieve Vision 2025. With a focus on ensuring future-readiness and an emphasis on partnership with the rest of the Primary Care ecosystem, we have distilled six strategic goals and are developing corresponding strategies to achieve them.

1. Fulfil the Tenets of Primary Care

Together with our GP and hospital partners in the region, we continue to pursue innovative and scalable ways to improve accessibility, comprehensiveness, and coordination of care.

2. Optimise Population Health

We seek to gain a deeper understanding of the population under our care, as well as strengthen partnerships with the community to enhance primary and secondary care prevention.

3. Activate Patients, Family, and Caregivers

Patients remain our first priority in our ecosystem. They are key 'players' in our empanelment teamlet care model, and more will be done to activate them and their families to make and sustain behavioural changes for better self-care and good health.

4. Research and Innovate

To drive our transformational efforts, we will invest more in developing a culture of innovation and Primary Care research, with the aim of scaling and spreading successful proof-of-concepts across our Primary Care ecosystem. Staff and partners will be encouraged to experiment with new ideas to enable our patients to live well.

5. Lead in Clinician Training

Clinician training must focus on the future, and we aim to provide our clinicians with the skills to manage conditions such as Frailty and mental health within Primary Care, more so with an ageing population.

6. Develop High-Performing Staff and Providers

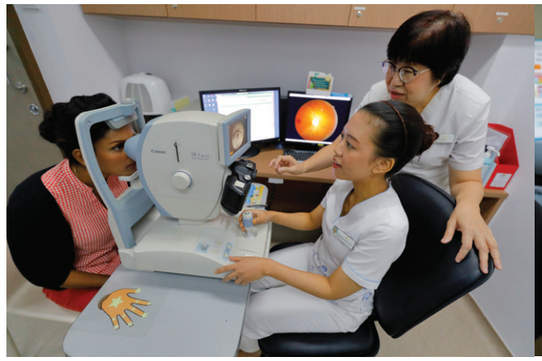
Emphasis will be placed on attracting, developing and retaining high-performing staff in NHGP, and over time to also raise the capability and standard of our Primary Care ecosystem providers collectively. This is done through on-going sharing and knowledge exchange, learning, and development.

To achieve these strategic goals, several system-level enablers will be crucial for NHGP. Integration of care across the various care settings will need to be further supported. We hope that with the Next Generation Electronic Medical Record (NGEMR) coming onstream in 2020, the flow of information for patient care across public health institutions will improve, enabling the development and sustaining of holistic integrated patient care plans. This is especially important for chronic care management. Patients should own and have access to their care plans which enhance communication and goal-setting between patients and care providers, to monitor each patient's progress.

Technology advances are changing the way in which our society communicates, obtains, and shares knowledge. Primary Care will need to adopt and adapt to new technology, and manage the accompanying risks, to stay relevant to how our patients live and work. Virtual access to care to complement clinic visits, technology-enabled self-monitoring, and patient education and engagement through mobile platforms are examples of how we are harnessing technology as part of care transformation. Machine-learning and Artificial Intelligence (AI) are also providing us with opportunities to do more and better, in view of increasing healthcare demand and a shrinking workforce. Primary Care providers will need to partner technology providers to contextualise the know-how, and develop effective and sustainable solutions which meet our patients' needs. Regulatory sandboxes which allow for experimentation and collaboration in new ways to deliver care will be necessary.

The future state of Primary Care will continue to be dependent on the building of strong relationships between the patient and provider, and provider-provider partnerships. While MOH reviews Singapore's healthcare financing model, NHGP and our partners continue to work closely and leverage on key enablers to improve our quality and integration of care.

Primary Care is the cornerstone of a sustainable healthcare system. The success of NHG's Primary Care Transformation will be a key determinant of whether the River of Life is a powerful, yet calm life-changing force.



MAINSTREAMING MENTAL HEALTH AND WELL-BEING

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

One in seven adults in Singapore has experienced a mood, anxiety, or alcohol use disorder in their lifetime. This was one of the key findings from the Singapore Mental Health Study (SMHS) 2016 led by the Institute of Mental Health (IMH). The nation-wide epidemiological study looked at the prevalence of common mental disorders in the Singapore resident population aged 18 years and above, their associated factors, as well as the population's help-seeking behaviour. It was also one of the few studies worldwide that made a deliberate attempt to track the mental health status of a country over a period of time. Compared with the first SMHS in 2010, we found that the prevalence of mental illness had increased, and that younger people, aged 18 to 34, emerged as the group more vulnerable to mental health issues.

While the SMHS 2016 showed that those who sought help for mental health issues were doing so sooner compared with SMHS 2010, more than 75 per cent of people with a mental disorder were not seeking any professional help for their problems. Why is this happening in a modern, developed country with a well-educated population? We think that this could be due partly to the inability of sufferers to recognise their distressing feelings and experiences as symptoms of treatable mental health conditions. The persistent societal and personal stigma associated with mental illness is another key reason. How can we do better?

A HOLISTIC APPROACH TO HEALTH - NO HEALTH WITHOUT MENTAL HEALTH

Often when we talk about health, we tend to overlook mental health or see it as separate from physical health. The two, however, are inextricably linked. Studies show that people with schizophrenia, bipolar disorder, and major depressive disorder (MDD) are more likely to also experience chronic conditions such as diabetes and heart disease, and have reduced life expectancy of between 15 and 20 years compared to the general population. These are common mental disorders; MDD is in fact the most common mental disorder in Singapore, with one in 16 people having experienced it at some point in their life.

Conversely, people with chronic physical conditions have a higher risk of developing mental health problems, like depression and anxiety, than the general population. If we compare two individuals who have diabetes or even cancer, research shows that the person who is mentally healthier tends to have better outcomes.

As we push ahead with a population approach to healthcare, an important question we have to ask ourselves is "What does it truly mean to be healthy?" The World Health Organization (WHO) defines health as a "state of complete physical, mental and social well-being and not merely the absence of disease or infirmity." This widely accepted definition recognises the interlinked nature of mental, physical and social well-being; and while we have some way to go in working beyond our areas of healthcare specialties, I would very much like to see a closing of the gaps between the three in our work. I hope that healthcare professionals across all disciplines will see individuals holistically, and attend to all aspects of their health — mental, physical and social. I believe that this will help to change how people view mental illness, and in turn reduce stigma.

We also need to look beyond illness to wellness. Being healthy does not only mean the absence or prevention of illness but rather living well, enjoying meaningful relationships, being productive at work, and being able to engage in and contribute to one's community, even if one is living with illness. Modern science and medicine today allow persons with chronic illness to continue living meaningful and happy lives, and this should be no different for those with mental illnesses.

TAKING CHARGE

Central to this concept of Living Well, even with illness, is the 'ownership' of health — empowering and motivating individuals to take charge of their health. One of the ways we are looking to do this in NHG is by incorporating health coaching as an adjunct to treatment. In fact, we are already doing this to some extent. Often when we see patients, we advise them to make lifestyle changes that will help to improve their health outcomes and quality of life. Long-term lifestyle change is perhaps the most important factor to sustain improvement, especially in the management of chronic conditions such as diabetes and hypertension as well as certain mental health issues. It is also often perceived as extremely daunting, to have to make changes to diet, exercise, and sleep, which have become lifelong habits. Health coaching focuses on this often difficult aspect of chronic disease management; the aim is to work with patients to draw out their self-motivation to make long-term changes and adopt health-supporting habits that will help them to achieve their personal goals.

For instance, an elderly man with poorly controlled hypertension and diabetes may not be motivated to reduce his salt and sugar intake just for the sake of being healthier, but health coaching could help this man to focus instead on being well enough to see his favourite grandson graduate from university, a meaningful enough reason to give up salt and sugar! Health coaching goes beyond curing individuals of their illness; it is about helping them to understand how their illness prevents them from living the life they want. It is about focusing on what they value most to serve as a catalyst for change.

FOCUSING ON JOY IN WORK

This focus on personal health and well-being is something that can help us as healthcare workers too. We all know that delivering high quality healthcare can be extremely challenging, and that healthcare professionals are facing increasing stress and burnout, not just in Singapore but worldwide. Stress and burnout in healthcare workers adversely affect the quality of care we provide to our patients. It can lead to lower levels of staff engagement and productivity, and higher staff turnover. How do we deal with this challenge? One way, the Institute of Healthcare Improvement in the United States says, is for the healthcare workforce to reclaim the "**Joy in Work**" that has led many to embark on a career in healthcare in the first place. We need to re-focus on the meaning of our work, to see how every minute of the day at work directly contributes to our personal goal of giving care to people in need. We should improve the communication we have with our colleagues, stop doing things that are not meaningful, and help each other so we do not feel alone and unsupported. I believe this is the way forward, and at the heart of this concept is to find meaning in what we do and what brings us joy in our work.

I have started a workgroup to explore how we can bring "Joy in Work" back to all at NHG, and am working with some very enthusiastic and passionate colleagues who want to develop this into a movement in NHG. "Joy in Work" will be a participative and voluntary process involving staff at all levels of NHG as we define what matters to us individually and as an organisation, understand the barriers to "Joy in Work", and how we can address them.

If we can learn to bring back "Joy in Work" among colleagues at all levels of NHG, I believe that we will be poised to show the way for other organisations to create a more positive work environment. We spend most of our adult life at work so it is important that our workplace is one that supports mental, physical, and social well-being.

BRINGING DERMATOLOGY CARE INTO THE COMMUNITY

ASSOCIATE PROFESSOR TAN SUAT HOON, DIRECTOR, NATIONAL SKIN CENTRE

Skin diseases are one of the health problems in Singapore that cause the most disability. In terms of Years of "healthy life" Lost to Disability (YLD), skin and subcutaneous diseases have been ranked as the fifth leading cause of non-fatal burden in Singapore[1].

Eczema is the leading cause of skin health problems, largely contributed by its high prevalence of 20 per cent in school going children and 11 per cent in adults[2,3]. Among the elderly aged 70 and above, there is a high burden of skin disease where eczema, ulceration, other skin conditions, skin cancer, infections, and pruritus are key issues[4,5].

Taken together, what the data suggests is that skin conditions affect a high proportion of the population, estimated at 30 to 70 per cent of individuals, across all cultures and ages.

QUALITY DERMATOLOGY CARE FOR THE POPULATION

In people affected by chronic skin diseases such as eczema and psoriasis, most hope to still enjoy quality living with good control (if not cure) of the condition. In Singapore where accessible healthcare is the norm, this notion is compounded with demands for quick and direct specialist care and a shorter waiting time to see a doctor.

However, there are challenges to this. In an era of expensive biologic drugs, selecting the most appropriate treatment will incur high cost for both the healthcare system and the patient. There are also aspects of psycho-social care that impact the clinical outcome of the condition which cannot be completely addressed by medication, and which goes beyond traditional delivery by the physician.

In Singapore, access to good quality dermatology care therefore requires the effective use of health resources.

MAKING DERMATOLOGY CARE ACCESSIBLE TO THE POPULATION

Since a great deal of dermatological care can be delivered at the Primary Care level, our efforts to shift care from the hospital to the community must continue to be encourged.

To ensure seamless integrated care at this level, the National Skin Centre (NSC) will continue to be the hub for polyclinics and General Practitioner (GP) network. Patients with skin conditions requiring a degree of specialised care now have the option of being treated closer to home through Tele-DERM, an e-consult service that enables Family Physicians at polyclinics to discuss skin care cases and treatment options with NSC dermatologists promptly. It reduces the need for patients to go for additional follow-up appointments at NSC, allowing them to receive dermatology care sooner and at their convenience.

In serving as a tertiary centre in this hub-and-spoke model, NSC will continue to facilitate inter-cluster transfer of patients who require complex diagnostic workup, phototherapy, medical or surgical treatment. The new NSC building, when opened in 2022, will have capabilities for specialised allergy testing and a facility to administer general anaesthesia, opening up opportunities for dermato-surgical procedures for paediatric patients and other more complicated dermato-surgical procedures. Team-based care for the management of chronic skin diseases will be the norm. While physician-led, such multidisciplinary teams ensure patients still receive good care from other healthcare professionals during home visits. Frail patients, in particular, will benefit from home-based care provided by Community Nurses from NSC or by care teams formed in collaboration with the Home Nursing Foundation (HNF).

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A FUTURE-READY WORKFORCE

In preparing our future physicians for the shift to more community and broad-based care, dermatology should be taught to all medical students. It should no longer be an elective and its training curriculum should be uniform, so that all medical students get to see the common and less common (but equally important) skin conditions that they may encounter in their practice, be it in the primary or specialist setting. This calls for a more innovative approach to education so that all medical students who rotate through the training centre in dermatology are taught to familiarise themselves with a core list of diagnoses. It will be an extension of what is currently done for our examinations. Common modalities of treatment can be taught by both physicians and non-physicians interactively, and this is what NSC has introduced.

The dermatology training programme should evolve to a standardised national training programme where a trainee goes through different care settings. This includes Acute Hospitals which may have select subspecialty capabilities geared for the community, as well as in NSC, which is a tertiary specialty centre with the full range of subspecialties. Medical students will therefore undergo a well-rounded training programme with exposure to different work environments; this will broaden their scope of career opportunities, giving them more options based on their professional aspirations and culture fit.

This model of education will also ensure continual training for physicians in areas that are core to critical service. In line with the shift towards broad-based generalist specialists in the hospital setting, dermatology rotations should be made compulsory for Internal Medicine trainees, either at the junior or senior residency level. This should also apply to Family Medicine trainees at the Primary Care level. The teaching faculty will therefore need to develop training curriculums tailored for specific groups – undergraduate, postgraduate non-dermatologist, post graduate dermatology specialists, and in addition, training courses for GPs and postgraduate dermatology fellowships to meet national and regional needs. The nursing and pharmacy training curriculum will need to be developed in tandem so that our healthcare professionals are empowered to practise at the top of their licence to support team-based care for the future.

DRIVING DERMATOLOGICAL INNOVATION THROUGH RESEARCH

Strong clinical care and a vigorous teaching culture need to be complemented with progressive research. Inter-institutional and inter-disciplinary collaborations are necessary to generate innovative and practical ideas that can be translated into improved clinical and healthcare outcomes for the population.

Thus, the Skin Research Institute of Singapore (SRIS), a collaboration between Agency for Science, Technology and Reseach (A*Star), Nanyang Technological University (NTU)/Lee Chong Kian School of Medicine (LKCMedicine), and NSC, was formed to harness the expertise and experience of scientists, engineers, and clinicians, to discover new treatments for some of the diseases that cause the most disability in Singapore. Such inter-disciplinary collaboration not only promotes industry partnerships but actualise translational research outcomes and commercial applications for better population health outcomes and quality of life. Its skin research and innovation will also contribute to the global skin research community and help improve patient care.

Much effort has also been devoted to building a nurturing environment in which innovative ideas can flourish and take shape. Budding research talent can be cultivated through joint research collaborations and formal appointments with NTU/LKCMedicine and NSC, and through a harmonised governance framework for the NHG cluster. Grants from the National Medical Research Council (NMRC), NHG, and LKCMedicine will help to develop research talents and advance their research work, increasingly through the PhD route. Centre grants from NMRC are still critical to ensure core research manpower and infrastructure support. Competitive programme grants need to be secured based on where the most value can be gained, rather than as an all-inclusive grant.

As we move towards an era where community-based care will become the gold standard in population health management, specialist dermatology care should similarly strive to become wholly accessible and cost-effective. This can be achieved through providing multidisciplinary care, an education model that upskills Primary Care providers and translational cutting-edge research. Together, we will be able to improve the overall skin health of our population.

BUILDING A FUTURE-READY NURSING WORKFORCE

MR YONG KENG KWANG, DEPUTY CHAIRMAN, NURSING COUNCIL, NHG;
CHIEF NURSE, TAN TOCK SENG HOSPITAL

An ageing population. A higher chronic disease burden. An older and shrinking workforce. Evolving demands and expectations of patients and the population.

These converging factors have made it imperative for Singapore to make fundamental shifts in how and where healthcare is delivered to Singaporeans. The new approach is to promote good health throughout life, with emphasis on preventive care, and on continuing care at home and in the community. This transformation entails investing in people working in healthcare, and to prepare them with future skills so that they can continue to deliver the best and safe care regardless of care setting.

Nursing staff make up 44 per cent of the overall healthcare manpower in public general hospitals, of which 54 per cent and nine per cent are in the general wards and Specialist Outpatient Clinics (SOCs), respectively. With nursing at the core of the healthcare workforce, it is being reshaped and redesigned to effectively support our Care Transformation.

Established in May 2017, the NHG Nursing Executive Council seeks to drive and devise measures at system-level, and to harmonise best practices aligned to the new strategic thrusts identified by the Ministry of Health (MOH) Future Nursing Career Review Committee (FNCRC). They comprise the 'three Cs' – **Care**, **Competency**, and **Community**. The Council has since developed a blueprint to guide the Nursing Transformation efforts of NHG.

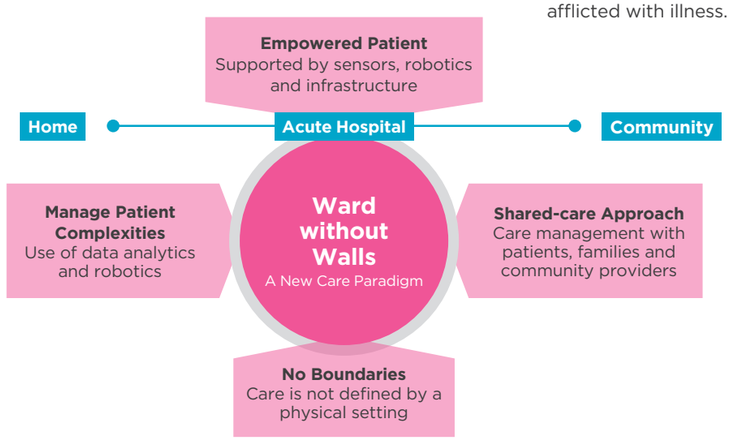
THE THREE STRATEGIC THRUSTS

Care: To enhance delivery of care and increase manpower productivity

We aim to empower and enable nurses to focus more on patient care by removing unnecessary work, improving their work processes, and boosting productivity by 10 per cent by 2020 and by 20 per cent by 2030. To guide our productivity efforts across the cluster, we have adopted the innovation cycle approach that is based on a framework to reduce waste by redesigning care and processes; cut cost by using automation, IT and robotics; and increase value through job redesign, such as upskilling, substitution, and expansion of job roles.

Collectively, these efforts will lessen administrative, non-clinical and non-essential clinical activities so that nurses spend their time more meaningfully on direct patient care.

Figure 1: NHG Ward without Walls Objectives



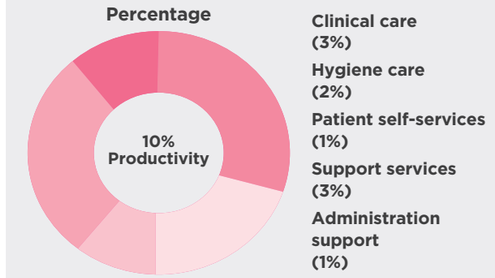
Increasingly, our nurses collaborate with inter-disciplinary teams to enhance patient experience, outcomes, and productivity. This shift in practice involves shared learning and knowledge exchange, and reframing mindsets and attitudes. Priority is given to augmenting care coordination, data analytics, assistive and sensing technologies, and quality and workflow improvements. As more of NHG nursing manpower is allocated to inpatient settings, we decided to lay the groundwork for productivity efforts in these areas.

Wards without Walls (WoW) is one such initiative. Its four strategic components not only guide and support nurses in managing care transitions in a timely, appropriate and seamless manner across various settings, but they too empower patients and their families to be actively informed and to participate in the care process. This aligns with our Vision for these stakeholders to take greater ownership of their health and to live fulfilling lives, including those afflicted with illness.

To achieve the goals articulated by WoW, more than 50 innovative ideas across the care spectrum have been generated and evaluated, and five key areas for productivity improvement have also been identified. The potential productivity gains for each area – Clinical Care, Hygiene Care, Patient Self-Services, Support Services, and Administration Support – have been estimated, and collectively, they make up the 10 per cent productivity target set for 2020 in the FNCRC report.

Many initiatives under WoW are work-in-progress, with timelines for their implementation and the actualisation of productivity gains estimated to be between one and three years, and three and five years, respectively. Technology and robotics can play a significant role in achieving a greater margin of productivity improvement, and they are being adopted in tandem with our continual review and redesign of best nursing practices and care models.

10% Productivity by year 2020



Competency: To practise at top of the Licence, provide direct patient care and implement role redesign

For nurses to take on expanded roles, the broadening and strengthening of individual competencies is critical. This requires changes to how we educate and train nurses to raise their job value, and to do likewise for support care staff.

Besides role redesign, role integration by incorporating relevant sub-specialised roles can help raise cost effectiveness and sustainability. For example, a Respiratory Specialty Nurse equipped with a wide range of skills in advanced respiratory care can sub-specialise in asthma care and also review patients with other respiratory conditions, where appropriate.

It is important to bolster the core competencies of NHG nurses across the board. Geriatric Care has been highlighted as a domain for NHG nurses to fortify their knowledge and skills — Tan Tock Seng Hospital's (TTSH) Geriatric Resource Nurse Training (GRN) is a potential programme for all NHG nurses involved in clinical settings. Other domains for consideration include transition care and palliative care.

With the increasing prevalence of co-morbidities leading to more complex cases, there is a greater need for nurses to be adept in multiple clinical domains. Hence, NHG advocates team-based competency where multidisciplinary healthcare professionals work together, and combine their respective expertise and training to implement more comprehensive, holistic care plans. The National Healthcare Group Polyclinics (NHGP) Teamlet Care Model is a good example. Patients are assigned to a Care Team comprising doctors, a Care Manager who is a nurse, and a Care Coordinator, often with positive patient outcomes and feedback.

Through such approaches, we hope to increase intra-cluster collaboration and improve NHG's ability to tackle the evolving healthcare challenges and seasonal/system demands.

Community: To engage the public in healthy living, active ageing, and continuous learning

As NHG works with our population to change the role of our healthcare system from one of "Provider of Care" to "Partner in Care", our nurses will be expected to move into the community to provide collaborative care that is characterised by person-centredness, continuity of care, self-care, and preventive health. This means the need to deploy more nurses in Primary Care settings, community hospitals, care centres, hospices, and homes to engage our population and enable right-siting of care.

In January 2018, an NHG Community Nursing Committee was set up to synergise efforts in the Central, Yishun, and Woodlands Zones. Besides leveraging on shared leadership from both clinical and non-clinical expertise in the areas of clinical protocol, IT, competency, and career development for Community Nursing, NHG has also been actively looking into improving work processes, and streamlining care delivery by our Community Nursing and Community Health Teams. As of September 2018, we have 81 Registered Nurses and nine Community Care Associates.

We will tier interventions based on needs, be it for the well, pre-Frail, Frail, and for those who require complex and palliative care. We will partner our patients from beginning to end, encourage them to participate in their care plans and eventually, cultivate a culture of health ownership. Our overall aim is to keep our population healthy, to slow down the progression of Frailty and/or pre-empt hospital admission with home care, and to facilitate more Advance Care Planning (ACP) to ensure our patients ultimately leave well.

The NHG Nursing Transformation Journey is daunting because of the multiple "moving pieces" required to fit together seamlessly. Yet when successful, the outcomes to be realised from this journey will be more impactful and sustainable. NHG has made good progress as we continue to work towards the targets under the 'three Cs' strategic thrusts. We will champion innovation and collective leadership at every level to deliver integrated, timely, person-centred, and safe care for our patients and the population we serve.

PHARMACY TRANSFORMATION FOR POPULATION HEALTH

MS CHAN SOO CHUNG, EXECUTIVE DIRECTOR, NHG PHARMACY

CHALLENGES AND OPPORTUNITIES IN THE CHANGING HEALTHCARE LANDSCAPE

Singapore's healthcare landscape is faced with the following long-term challenges: an ageing population with increasing chronic disease conditions, a declining workforce due to lower national fertility rate, rising healthcare costs, higher expectations for value-driven patient-centred services, rising staff expectations and career aspirations due to higher education, and the impact of technology advancement on the future of work.

The issues with medication are increasing, with rising incidences of chronic disease alongside the development of more potent medicines. Medication use and outcomes are not optimal and medication-related hospital admission rates are a concern. Some of these concerns can be attributed to poor communication and coordination of care across different settings as patients consult multiple prescribers, raising the risk of medication errors and drug wastage. More needs to be done to holistically manage concomitant conditions, systematically identify and address the medication problems faced by patients, increase patients' ownership of their health, and help them understand the medicines they are taking.

The advancement of medical technologies and automation brings many opportunities and will rapidly change the role of the Pharmacy Workforce. For example, it is already possible to tailor the right therapy based on the characteristics of a person's genetic profile to obtain the best outcomes in the management of some cancers. With the help of pharmacogenomics, the pharmacist will have the information to determine the likely response of the patient to the drug and be able to better optimise medication use and personalise the therapy. Advancement of Precision Medicine requires better trained pharmacists to understand and drive the use of pharmacogenomic data to optimise medication therapy.

The use of automation for inpatient and outpatient medication dispensing has freed up manpower from the mundane work of picking and packing medication. The shift from a distribution function to a more patient-focused role can now accelerate in tandem with the changing models of care.

In addition, the digital transformation wave of big data analytics, machine learning, Artificial Intelligence (AI), and the Internet of Things (IoT) will change the way pharmacy operates and how the public will eventually gain access to medication. It will allow analysis of trends from prescription records, and help identify poor adherence.

NATIONAL PHARMACY STRATEGY

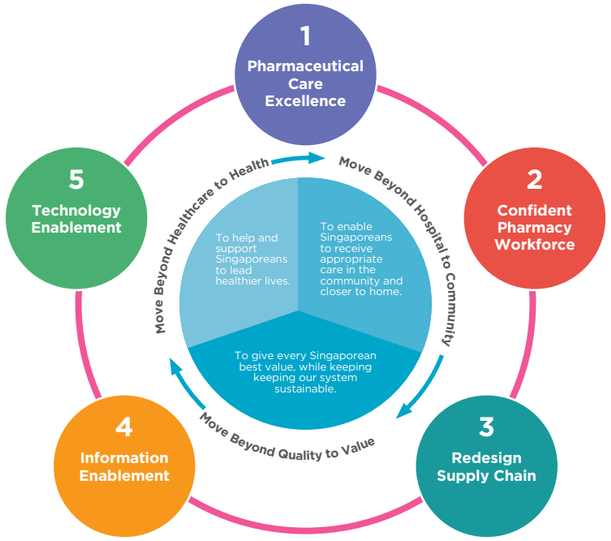
The National Pharmacy Strategy (NPS), launched by the Ministry of Health (MOH) in 2017, outlines five key strategic thrusts to transform the pharmacy landscape:

1. **Pharmaceutical Care Excellence**
2. **Confident Pharmacy Workforce**
3. **Supply Chain Redesign**
4. **Information Enablement**
5. **Technology Enablement**

The Pharmacy Leadership Teams across Institutions have been actively involved in the planning and delivery of these strategies which involve changes to drug formulary policies, education and training of pre-registration pharmacists, development of advanced practitioners, career and skills development of pharmacy technicians, development of the National Harmonised Integrated Pharmacy System (NHIPS), Pharmaceutical Care Services for the community, and the formation of the Supply Chain Organisation – ALPS Pte Ltd.

Figure 1: The National Pharmacy Strategy

THE NATIONAL PHARMACY STRATEGY (NPS) HAS 5 KEY THRUSTS THAT ALIGN TO THE KEY SHIFTS IN THE HEALTHCARE TRANSFORMATION STRATEGY



1. Pharmaceutical Care Excellence
Enhancing pharmacy services that bring health and value for everyone in our community

2. Confident Pharmacy Workforce
Providing a skilled, future-ready, and innovative Pharmacy Workforce

3. Redesign Supply Chain
Delivering seamless, convenient, accessible, affordable, and safe medications at every point of care

4. Information Enablement
Empowering people to get the best out of their medications and achieve care goals

5. Technology Enablement
Delivering seamless and effective transition of care across all care settings through technology as an enabler

PHARMACY TRANSFORMATION

The Pharmacy Leadership in NHG also addressed the challenges facing the workforce and the medication-related problems experienced by patients. The Shared Vision of "Keeping the Population Well through Safe and Appropriate Medicine Use" was hence developed.

The three key priorities for change endorsed by NHG Senior Management were to improve the Quality of Prescribing, Medication Adherence, and to establish the flow of the Single Source of Truth for medication information. With MOH's initiatives as a foundation, a Pharmacy Transformation Steering Committee (PTSC) chaired by Mrs Chew Kwee Tiang, CEO, Khoo Teck Puat Hospital (KTPH) and Yishun Health, and Associate Professor Thomas Lew, Chairman Medical Board, Tan Tock Seng Hospital (TTSH) and Central Health, was set up to spearhead the pharmacy transformation initiatives across NHG Institutions. The PTSC reports to Dr Jason Cheah, Deputy Group CEO (Transformation), NHG, and CEO, Woodlands Health Campus.

Three workgroups, namely, **APPRAISE**, **ONE-PML**, and **ELITE**, comprising representatives from various NHG Institutions were formed to drive the three key thrusts of **Quality Prescribing**, **Medication Information Flow**, and **Patient Activation**.

Quality Prescribing

The pharmacist is well-placed to review the appropriateness of prescriptions, monitor drug treatment, and check for potential adverse drug reactions and drug interactions. Pharmacists intervene in the choice of drug, dosing regimen, and route of administration to improve medication safety, efficacy, and adherence. Being specifically trained in drug therapy, integrating the pharmacist into the healthcare team will improve quality, safety, patient satisfaction and reduce costs. The APPRAISE workgroup's focus is on designing tools and curriculum to boost the competency of the Pharmacy profession to conduct accurate assessment of patient's needs and optimise therapy for better outcomes. The workgroup also explores new practice models and skills (for example, motivational interviewing, and shared decision-making) needed to shift the Pharmacy Workforce towards a more value-adding clinical role.

Currently, the data collected is being analysed to identify the segment of patients who are at high-risk of experiencing drug-related problems and who will benefit from closer monitoring and reviews. Work is also in progress to develop a guide to conduct systematic patient assessment, medication reconciliation, medication review, and develop the pharmaceutical care plan.

APPRAISE is the acronym for **A**ppropriately **P**ropagating care**P**lans towards the **R**esolution of DRPs related to **A**dherence, **I**ndication, **S**afety and **E**fficacy
ONE-PML is the acronym for One-**P**atient **M**edication **L**ist
ELITE is the acronym for its mission: **E**mpowering patients and/or caregivers through health **L**iteracy, **I**nformation **T**echnology and **E**ducation

Medication Information Flow

The risk of medication errors is the highest during transitions of care. This is due to multiple factors such as the lack of communication and coordination among healthcare providers, patients' difficulty in remembering instructions post-discharge, as well as confusion over changes in medication. This is compounded by the different incomplete sources of patients' medication information, which often makes the work of reconciling the Patient's Medication List (PML) very complex and time-consuming.

The ONE-PML workgroup strives to enable a seamless communication of accurate, complete, and trusted patient's medication information across disciplines and care settings. Workshops have been held to understand the issues and co-create the process flow of information. These were attended by different stakeholders from the acute hospitals and Nursing Homes, and proved to be very fruitful as participants were keen to collaborate and resolve the issues they have faced for a long time.

Separately, the pharmacists at the polyclinics have implemented the process of medication reconciliation targeting recently discharged patients from the acute hospitals. Changing the sequence of the patient's journey to see the pharmacist before the doctor (instead of being the last stop), resulted in a significant reduction in the incidence of prescription errors. Through patient interviews, the pharmacists were also able to identify many drug-related problems and resolve them. At the end of the visit, patients are given their Medication List, and benefits as well as side effects explained.

Patient Activation

As Singapore's healthcare needs get more complex, the ability of patients to understand their medical condition, ask questions about their therapy and follow instructions becomes critical to their continued health. Many studies have linked low health literacy to poor health. Conversely, the more active and engaged the patients, the more they can manage their own health.

Among the patients with chronic diseases, studies have shown that poor medication adherence is the top medication-related problem faced. The ELITE workgroup focuses on improving the pharmacy health literacy awareness among staff, developing communication strategies to engage and empower patients and caregivers, and developing assessment tools to identify poor medication adherence.

The workgroup organised the NHG's Cluster Campaign "Know Your Medicines, Get it Right," held in conjunction with Pharmacy Week in October 2018, to increase awareness about the importance of creating one's own PML. In collaboration with National Healthcare Group Polyclinics's (NHGP) Patient Education and Activation team, frontline pharmacy staff are being trained in health literacy concepts and effective communication, to strengthen their confidence in supporting patients and caregivers to better understand their medication and make decisions in managing their medications and conditions. A tool to identify medication adherence issues is currently being validated.

SAFE MEDICATION – ACROSS AND CONNECT

In order to address the medication challenges faced by patients who seek care in multiple settings, Pharmacy Transformation at NHG has rolled out two projects — **ACROSS** and **CONNECT**.

ACROSS (Activation, Communication and Rules Of engagement for Single Source of truth)

The projects aim to provide safe medication across NHG Institutions. They redesign current workflows to prevent harm, address medication information needs, and activate patients.

1. **S**tandardise **M**edication information **U**pdate, **R**etrieval and **F**low across NHG (SMURF)

   Targeting prescribers across all our Institutions, SMURF enables the standardisation of prescribing guidelines across NHG.

2. **S**upport through **CO**mmunity & **P**atient **E**ngagement (SCOPE)

   SCOPE is aimed at patients discharged from the hospital in transition to the polyclinic and community. It helps to assess a patient's risks and needs, and administer relevant assistance prior to discharge and for polyclinic follow-up.

3. **S**treamline from **HO**spital to **P**olyclinics (SHOP)

   SHOP focuses on polyclinic patients referred by the hospital for further intervention at NHGP's medication clinics. It streamlines the patient journey and medication clinic work processes, such that patients with potential medication problems can seamlessly move to polyclinic medication clinics for further intervention.

4. Updated medication list for **C**omplex **C**are patients **A**cross **M**ultiple **I**nstitutions (CCAMI)

   Designed for complex care patients in Specialist Outpatient Clinics (SOCs) visiting multiple prescribers across NHG Institutions, CCAMI helps to identify and share medication lists for complex care patients, who are concurrently chronic patients of TTSH, KTPH, and NHGP.

CONNECT (COnnecting NHG and Nursing Homes through rules of Engagement, Communications and single source of Truth)

The project works to establish and facilitate open communication between Nursing Homes and NHG (inpatient and SOC). It ensures a platform and workflow for PML creation, documentation, maintenance and flow; and rules of engagement and communication channels.

COLLECTIVE LEADERSHIP AND COLLABORATIONS

To facilitate systemic changes and collective ideation, the Pharmacy Transformation team has created several platforms for networking, engagement, and teaming among the various healthcare professionals and other stakeholders.

The TTSH Kaizen Office was engaged to facilitate a "Go-and-See" exercise, involving a total of 60 doctors, nurses, pharmacists, administrators, and other professionals, to observe the patient flow and transitions across 20 sites including acute hospitals, polyclinics, community hospitals, Nursing Homes, General Practitioner (GP) clinics, and patient homes. Future State Mapping workshops, also involving diverse groups of stakeholders, were conducted in 2018 and 2019 to jointly define the dream state and conceptualise proof-of-concept pilots. Through such workshops, participants had the rare opportunity to work with people across healthcare settings, understand different perspectives, and visualise the end-to-end processes. Champions were also identified to spearhead the various Pharmacy Transformation initiatives.

The table below summarises the feedback from patient focus groups and Future State Map workshops conducted with stakeholders, on what patients need and value about medication management.

Figure 2: What Patients Need and Value

PATIENT ACTIVATION AND ENGAGEMENT Confused → Activated		HARM PREVENTION Errors → Quality Prescribing		MEDICATION INFORMATION FLOW Fragmented → Holistic	
Patient's Value	**What We Can Do**	**Patient's Value**	**What We Can Do**	**Patient's Value**	**What We Can Do**
I UNDERSTAND and can **COMMUNICATE** information regarding my medication and medical condition	Patient awareness and education	I expect my medication therapy to be **APPROPRIATE**, **COST EFFECTIVE** and **SAFE** for me	Harmonised prescribing practice	I expect my healthcare providers across settings to **KNOW MY CONDITIONS WELL** and I do not have to repeat myself	Communication channels among healthcare professionals across care settings
I **KNOW** my medications and **UNDERSTAND** how they work	Effective communication channels with patient and caregiver	I want a **SIMPLE** medication plan with less pills to take. Don't **OVER-TREAT** me	Common Care Plan	I am supported by a **COORDINATED CARE TEAM** across settings	Visibility of complete patient medication information to all healthcare professionals
I need only **RELEVANT** information to be given to me in **EASY** to understand **LANGUAGE**	Information communicated in preferred language, avoiding jargon	I want to make **JOINT DECISIONS** with my healthcare providers regarding my medication therapy	Shared Rules of Engagement among healthcare professionals	I receive **CLEAR, RELEVANT and CONSISTENT** information from all providers	Shared Rules of Engagement among healthcare professionals
I must be **HEARD** and **RESPECTED** by my care team	Multilingual medication labels, pictogram	I want **AFFORDABLE** care	Optimised medication therapy	I want **CONTINUOUS RAPPORT** with any care team, and not transactional rapport	Streamlined upstream and downstream processes
I need consistent **SUBSIDIES** no matter where I am	Medication reconciliation and review		Shared decision making		Common IT platforms shared across NHG Institutions
	Community support		All healthcare professionals maintain a single source of truth for medication list		Common Care Plan
	Portability of subsidies		Harmonised drug formulary		

For the first time in NHG, the issues with medication are being tackled on a large scale by a multidisciplinary group. There have been surprising discoveries, immense learning, and many intense discussions due to its complexity. As the teams develop new prototype workflows, they are concurrently developing new capabilities including problem-solving, strategic-thinking, communication, engagement, and leadership.

As one of the enablers for the River of Life Transformation Journey, we will have both the challenging and exciting task of engaging and aligning with all the workstreams due to the inter-related aspects of patient care.

TRANSFORMING ALLIED HEALTHCARE FOR POPULATION HEALTH

MS SUSAN NIAM, CHAIRPERSON, ALLIED HEALTH SERVICES COUNCIL, NHG

Allied Health Professionals (AHPs) apply their expertise in preventing, diagnosing, and treating a range of conditions that may be through the provision of direct patient care, rehabilitation, treatment, diagnostics, and health improvement interventions that help restore and maintain optimal physical, psychological, cognitive, and social functions. AHPs in NHG work as part of multidisciplinary teams, and include a wide range of fields and disciplines, such as Dietitians, Medical Social Workers, Medical Technologists, Physiotherapists, Podiatrists, Prosthetists/ Orthotists, Psychologists, Occupational Therapists, Radiographers, Radiation Therapists, Respiratory Therapists, Speech Therapists, and others.

With Singapore's rapidly ageing population and rising prevalence of chronic diseases, healthcare needs will increase. This, coupled with growing constraints in manpower resources as a result of reducing birth rates, has made a strong impetus for Allied Health Services to be transformed. The NHG Allied Health Services Council (AHSC) is dedicated to looking at optimising the ability of AHPs and Allied Health support staff to better address the growing needs of the population, as well as developing innovative ways of service provision and models of care that break away from traditional professional-intensive approaches.

WORKFORCE DEVELOPMENT

Training of our AHPs and Allied Health support staff will need to evolve to equip them with the requisite skills and knowledge to support patients, including the elderly, for sustainable and good delivery of rehabilitation and preventive care.

Entrustable Professional Activities (EPAs) are currently being developed at the national level with support from the Clusters, to better guide the development of future-ready AHPs upon graduation from their professional training. Through this integrated school and industry approach, it is envisioned to help produce graduating AHPs who have the competency to manage patient care in a way that is contextualised to work practices. Examples include discharge planning EPAs which, hopefully, would beef up the awareness and ability of new AHPs to better support Institutions in their care planning for patients.

For experienced AHPs, the AHSC is working on the development of more advanced roles that will be built as an expansion of the core professional knowledge base of the Allied Health professions. Through training frameworks designed for specific expanded scopes of practice, AHPs can be developed to add value to the overall patient journey by right-siting care and unlocking access to early AHP intervention. An example of this is the collaboration in Tan Tock Seng Hospital (TTSH) between Orthopaedics Surgery, Physiotherapy, and Occupational Therapy, whereby care protocols of common conditions are developed together by the three departments such that non-serious cases or cases not requiring surgery could potentially be seen directly by the therapists. Therapists will be trained to ensure competency in the triaging and escalation process.

At Khoo Teck Puat Hospital's (KTPH) Extended Diagnostics and Treatment Unit (EDTU), selected patients have access to expedited podiatry care services at the Emergency Department (ED). This initiative not only helps to address podiatry-specific concerns of ED patients with input from both podiatrists and physicians in a timely manner, it also helps reduce unnecessary admission to the wards. Outpatient appointments can also be arranged after a definitive care plan is discussed with the patients, where necessary.

Allied Health support staff such as Allied Health Assistants (including Therapy Assistants, Podiatry Assistants, and Social Work Assistants) have always been integral members of the Workforce. Traditionally, they play an important role in providing assistance with patients or with machinery. With training that is designed to help them develop deeper patient management skills, this group of staff will be able to take on expanded job roles and across settings or professions, or to take on higher patient care roles. For example, Podiatry Assistants in TTSH, KTPH, and Admiralty Medical Centre (AdMC), with competency training, have taken on the tasks of standard foot screening and simple nail care cases. In the Institute of Mental Health (IMH), multi-skilled Therapy Assistants are now able to work in a transdisciplinary manner to provide support for Physiotherapy, Occupational Therapy, and Psychology in the long-stay ward. In TTSH and Yishun Community Hospital (YCH), Therapy Assistants have been upskilled to conduct group exercises independently and to manage the rehabilitation of specific groups of patients through a more hands-on approach. In addition, Social Work Assistants in YCH have been upskilled to undertake tasks such as social screening and triaging, care planning, and case documentation. Currently, NHG Institutions are embarking on the co-development of enhanced training for Therapy Assistants by first aligning core competencies, and subsequently enhanced competencies.

MODELS OF CARE TRANSFORMATION

In tandem with manpower training and development, models of care in Allied Health also need to be transformed. The AHSC is spearheading the development of new models of Allied Health care provision for a more efficient and integrated continuum for patients across Primary Care, acute hospitals, Community Care, and homes. Another key thrust is the development of an integrative and coordinated approach among Allied Health professions delivering care for patients with broadly similar rehabilitative needs.

Transformation of Outpatient Allied Health Services

A current plan being explored is to transform outpatient Allied Health services. It involves the development of a new care model for musculoskeletal therapy services where appropriately-skilled AHPs can provide early intervention for patients who are waiting for their Specialist Outpatient Clinic (SOC) appointments. These services could be sited at dedicated centres in the community to bring about greater ease and timely access to patients. The number of SOC appointments can potentially be reduced as early intervention by the AHPs helps alleviate symptoms and prevents deterioration into chronic conditions.

Exploration of an Integrative Model of Care among Allied Health Services

A common issue that patients face is the many touchpoints that he/she will have to meet, in order for their health and social needs to be addressed. These multi-faceted needs of a patient have led to the creation of multidisciplinary teams in the past. This approach, although good in intentions, has also created hand-off and communication gaps that sometimes leave patients confused. Patients may end up paying more if they are required to attend more appointments. It is time for us to look for opportunities to ensure synergy in care among the different Professionals and to streamline our clinical approach.

The AHSC hopes to map out areas of care that converge between Allied Health professions and encourage more inter-professional dialogues, developing transdisciplinary practice that is enabled through a defined system of cross-training of competencies. An example of this is the area of providing psychological support to patients at home. The Allied Health team in IMH, comprising Pharmacists, Psychologists, Medical Social Workers, Occupational Therapists, and Case Managers, is working on piloting a Transdisciplinary Allied Health Skills and Knowledge framework where identified discipline-specific skill-sets can be applied by most AHPs to address simple needs of patients before referring or escalating to other AH disciplines, thus reducing unnecessary hand-offs between AHPs in the patient's care continuum. A similar approach is also being tested at TTSH between Physiotherapy and Occupational Therapy. Patients in the wards who are referred for functional reviews and whose care needs are not complex in nature would be managed by either a Physiotherapist or Occupational Therapist, but with regular communication between the two Professionals. KTPH has piloted a project, where either a Physiotherapist or Occupational Therapist who has undergone transdisciplinary training will be deployed to provide Allied Health care services to suitable patients at home.

These various Allied Health initiatives are part of NHG's overall Care Transformation to deliver integrated, holistic, and person-centred care to our patients and the population we serve. We hope that through the redesigning of the roles of support staff and AHPs, we can contribute to an overall Team-based role redesign. We also hope that through new models of care, we can keep healthcare sustainable, accessible and affordable. While challenging, the successful implementation and adoption of such approaches will ensure that our Allied Health care resources continue to be effectively allocated to support the increasingly complex needs of our patients and population within the community, and achieve impactful, sustainable outcomes.

WALK AT THE PACE OF THE COMMUNITY

MR DAVID DHEVARAJULU, EXECUTIVE DIRECTOR, CENTRE FOR HEALTHCARE INNOVATION
ASSOCIATE PROFESSOR WONG HON TYM, CLINICAL DIRECTOR, CENTRE FOR HEALTHCARE INNOVATION

Health Minister Mr Gan Kim Yong launched HealthCity Novena on 30 Aug 2013. Five years on, the Ng Teng Fong Centre for Healthcare Innovation (CHI), the first of several new developments for HealthCity Novena, was completed and officially opened on 9 May 2019. The nine-storey building is built with a focus on advancing innovation, engagement, and co-learning.

THE NEED FOR TRANSFORMATION

Mr David Dhevarajulu: Two considerations are accelerating our Workforce Transformation: the labour crunch means our local manpower needs to innovate, and the new collective landscape necessitates transdisciplinary, and team-based work, where we have to operate with digital dexterity by leveraging on Artificial Intelligence (AI).

Associate Professor Wong Hon Tym: On the clinical front, three trends necessitate change. First, we are expanding our care beyond the brick-and-mortar hospital into the community. Second, we are focusing our efforts upstream via lifestyle, prevention, screening, and health promotion, to make more 'health' happen, so less healthcare needs to. Third, we are seeing the advent of new technologies, and seek to understand existing systems to better integrate them.

BIRTH OF CHI

Mr Dhevarajulu: About six years ago, Tan Tock Seng Hospital (TTSH) embarked on its **'Better People, Better Care, Better Community'** journey to create sustained improvement – collectively. We recognised then that the existing research-driven mental model of healthcare ("I see one, I do one, I teach one") was no longer effective. Thus, the Centre for Healthcare Innovation (CHI) was born.

We decided on the name "Centre for Healthcare Innovation" once we determined we were training our healthcare workforce for the future. The name CHI also stands for *"chi"* (energy in Chinese), and we hope this *chi* – ideas, best practices, and collaborations – will "flow out" into the community. We want to open the doors to tomorrow's healthcare, and redesign it to help transform our Workforce.

CHI's mission is to establish an ecosystem for healthcare innovation and co-learning. To achieve this mission, we have a three-pronged focus:

- **Building Thought Leadership** – We work in collaboration with a diverse network of care providers and industry partners and through co-learning and dialogue, we have the opportunity to translate concepts into practices. CHI brings together the diverse mental models of various organisations – both successes and failures – and acts as a node to provide Thought Leadership for the workforce.
- **Workforce Transformation** – We build a sustainable workforce through care and process redesign, use of automation, IT, and robotic innovation to drive productivity.
- **Training through Pedagogies** – We need to build capabilities to ensure a workforce that is appropriately skilled for future healthcare models, and one that can innovate on-the-go.

Overall, CHI aims to build a workforce that is sustainable, where work is meaningful and contributes to fruitful care relationships.

BUILDING A WORKFORCE THAT IS SUSTAINABLE

Mr Dhevarajulu: To build a sustainable workforce, we need to look at the entire journey of a patient's life. We need to prepare both our formal and informal workforce, and engage them in transdisciplinary work over the course of a lifetime.

We need to make the formal workforce ready to morph. We are engaging our workforce by bringing them close to the core business. For example, we have reviewed the careers of Patient Service Associates (PSAs) – who previously acted mainly as doctor's assistants – and say to them: *"You can do more for patient care, and you can do even better over time."* We provided them with diverse options to develop. Today, our default phlebotomists are PSAs. Retention of staff has also improved because they are able to contribute more directly to the core work important to our organisation, which is more motivating. We are developing meaningful relationships between patients and providers. The mindset we encourage providers to have is: *"Can I treat a patient the way I treat my grandmother?"* With new clinical tools of engagement, coaching, and building relationships in place, people recover better, and medical and patient compliance goes up. In addition, our transformed workforce will not be contained within the hospital. More of our work will be in the community, providing social prescriptions in addition to medical ones.

A/Prof Wong: We also look for innovative solutions that tap on non-traditional populations – the largely untapped informal workforce of home-based carers: patients' relatives, children, and domestic helpers. When we educate the community, they become a part of the "doctoring" process.

CREATING WORK THAT IS MEANINGFUL

For work to be meaningful, healthcare providers need to deliver care that patients value, co-create a better experience for patients, and drive value through improvement and innovation. To-date, CHI has 93 projects in total – 48 projects have begun, 28 targeted for the future, and 17 are community enablers.

Mr Dhevarajulu: Meaningful work is generated through innovative products, services, and/or system-level changes. The Ng Teng Fong Healthcare Innovation Programme (NTF HIP) serves as a financial lever of innovation, and helps fund the innovation work and programmes facilitated by CHI.

One example of CHI's product innovations is a handheld self-monitoring device, *iCare*, which activates glaucoma patients to perform self-care aided by a Nurse Clinician well-versed in glaucoma care. This reduces patients' visits to the eye clinic, and frees up doctors' time to manage more complex patient cases. *Jintronix Virtual Reality* is an example of service innovation. This project redesigns care delivery through tele-rehabilitation services that complement existing outpatient therapy services. It therefore increases patient activation and satisfaction, and achieves better health outcomes through higher compliance with rehabilitation exercises.

A/Prof Wong: To generate meaningful work, we must understand and prioritise our patients' values and integrate that with our own. Only then can we generate sustainable, system-level change. Given this context, we need to move the formal workforce from technical Key Performance Indicators to value-based outcomes. Doctors, nurses, and Allied Health Professionals (AHPs) are often satisfied with technical outcomes. Understanding what is important to a patient is more crucial than prescribing a one-size-fits-all solution. "*How stable was the implant after the surgery?*" needs to be considered in combination with "*How happy and re-engaged in life goals was my patient after surgery*?"

CONTRIBUTING TO MEANINGFUL CARE RELATIONSHIPS

A/Prof Wong: For meaningful care relationships to happen, paradigms of the formal and informal workforce need to change. We all need to develop more "soft" relational skills. We also need to be respectful when collaborating with Non-Governmental Organisations (NGOs), Voluntary Welfare Organisations (VWOs), and other Community Care providers. The traditional hierarchy is dissolving.

When we bring in new paradigms, or new innovations, we must be prepared to support each other to weather public prejudices or the criticism of naysayers, even from within our ranks. When we show that we are able to consistently produce good value work, we can then earn trust. For example, TTSH's success in deploying optometrists for primary eye care and tele-ophthalmology arose when we understood a need for a system to improve the quality of hospital referrals. Years of fierce cynicism only abated after we persisted and achieved high patient satisfaction rates and good audit results.

Partners adopt a "do-learn-share" and "share-learn-do" model to share knowledge, and build experiences and connections. One partnership across hospital, educational, and industry sectors in CHI's Co-Learning Network is the *Make-A-Thon*, a competition collaboratively hosted by Nanyang Polytechnic and TTSH, to guide novice inter-disciplinary teams to design and prototype solutions to meet identified healthcare needs. An innovation that resulted from this partnership was a multi-functional chair that aids inpatient rehabilitation and facilitates conducive rest for caregivers. This chair is especially interesting because the idea was ground-up and the care needs sensed were fairly accurate.

CHI establishes international partnerships as well. One of the fruits of CHI's international Co-Learning Network partnerships is TTSH's adoption of Thailand's Siriraj Hospital's *Routine-to-Research* (R2R). R2R empowers staff by encouraging independent research work. Knowledge from their efforts is translated into practice for patient health services, enhancing patient care delivery.

Mr Dhevarajulu: CHI is positioned to be a node of best practices, and a hub for its network of co-learning partners. Meaningful care relationships can be developed through CHI's Co-Learning Network and its envisioned national Knowledge Management (KM) platform. Through CHI's KM platform, stakeholders can ask questions that offer more information, point to persons with similar needs, and connect people with similar solutions. This is activation in motion. We cannot be everywhere all the time, but this system will be available 24/7. The KM will also gather all problem statements across hospitals and the community, enabling us to problem-solve effectively. We will prioritise problems that the majority struggle with, and take a system-level approach to solving shop floor situations. Ultimately, we seek to co-create at the pace of what the community is ready for, and build ownership, instead of rapidly launching solutions that do not gain traction.

THE FUTURE OF CHI

A/Prof Wong: I won't say there is a future state. But 10 years from now, if we look back and see that how we operate has changed – satellites doing the work of hospitals with technological links to a central hub, doctors and nurses doing different things, quiet clinics where patients are given needed attention – we would have succeeded.

Mr Dhevarajulu: I don't think there ever is a "future state". We are looking at visionary work. As we move from decade to decade, definitions of what is a sustainable workforce, what is meaningful work, and what are meaningful care relationships will grow and change. But the intent of these three phrases will keep us engaged and innovative. At an early council meeting, Mr Göran Henriks (Chief Executive of Learning and Innovation; Qulturum, Region Jönköping County, Sweden) asked, *"Why does the population need CHI?"* Our reply, at the end of the day, is not whether it can be done. Singapore can make it happen, with public readiness and proven examples of success. The question is: "*When can I take my hands off the rudder?*"

NHG'S POPULATION HEALTH JOURNEY: ALL HANDS ON DECK

DR WONG KIRK CHUAN, CHIEF OPERATING OFFICER (POPULATION HEALTH), NHG;
CHIEF OPERATING OFFICER, WOODLANDS HEALTH CAMPUS

NHG's *River of Life* (ROL) Framework is a blueprint for healthcare providers to partner empowered patients and an activated population as lifelong co-owners of health, beyond conventional hospital-based care. Our population comprises:

- People who are Well
- People with Illnesses
- Individuals who require Crisis and Complex Care
- The Frail
- The Terminally Ill

As population health also encompasses the social aspects of health influences, we need 'all hands on deck' – practitioners (health and social care organisations), as well as the community (patients, caregivers, and those who are well) – to keep our population holistically well.

HAND-IN-HAND: PARTNERSHIPS BETWEEN PRACTITIONERS AND THE COMMUNITY

A key tenet of population health is to enable people to take charge of their own health, and that of their loved ones, as well as other members in the community. Healthcare providers will thus move from a paternalistic approach to care to become **partners in care**.

As our population ages, the demand on hospital-based and specialist care will be high, leading to the twin challenges of cost and manpower. By actively taking steps in the community, we can help prevent the onset of chronic illnesses, delay complications, and support our patients in the community even after an admission to the hospital. For example, having the right support in the home setting – in a warm, familiar environment – can help patients recover independently and prevent re-admissions. Adequately-equipped family members can help patients go about their daily lives: personal care at home, showering, and changing, in the absence of a professional caregiver. We also aim to have seamless care transitions between the hospital and the community.

Besides providing Community Care for persons who are unwell, collaborations with the community help to create everyday spaces that are conducive for health. At Kampung Admiralty, for example, a partnership with Christchurch Secondary School to stage art competitions helps promote healthy habits and foster a community that celebrates wellness. Inter-generational programmes such as the Tri-Generational HomeCare@Northwest (TriGen) and Community of Hope (CHOPE) involve university and secondary school students pairing up with the elderly who need health and psycho-social support. Experiential learning and mentorships build empathy among students who then design creative activities to meet seniors' needs. Through these various ways, we seek to create a **"Culture of Health"** ground-up.

HAND-IN-HAND: PARTNERSHIPS BETWEEN HEALTH AND SOCIAL CARE ORGANISATIONS

Collaborations between health and social care organisations within the three zones in the Central Region – Central, Yishun, Woodlands – promote smoother transitions across the care continuum. Today, there is greater emphasis placed on the social aspects of care given the multiple social determinants of health. For instance, a resident's access to proper nutrition, which affects his health and well-being, may well be affected by socio-economic factors. Healthcare providers are therefore engaging different stakeholders, including social organisations, in the community. Hospitals are building Community Networks and creating different capabilities nested within the community to serve patients and the population. This is demonstrated through many institution-initiated, community-based programmes that facilitate health engagement, care coordination, and ageing-in-place. For example, Khoo Teck Puat Hospital's (KTPH) Ageing-In-Place programme (AIP) addresses population health needs in various ways, such as by setting up Community Nurse Posts (CNPs) in 10 divisions of the Nee Soon and Sembawang Group Representation Constituencies (GRCs) to serve as touch points in the community for people to seek health advice. This zonal approach to population health helps to connect the hospitals to the community they serve, and enables providers to better understand the needs on the ground, thus allowing for better place-based care. Underpinning this is a strong Primary Care ecosystem, spearheaded by National Healthcare Group Polyclinics (NHGP) in concert with our General Practitioner (GP) partners.

HAND-IN-HAND: PARTNERSHIPS ACROSS INSTITUTIONS

Our population health efforts have grown in scope and quality by building on the diverse strengths of our Institutions. Various clinical programmes are now combined more easily and scaled, cross-sharing has shortened the learning curve, and the reach of our programmes has also accelerated and widened. Pooling our collective capabilities spurs synergy, and minimises redundancies and duplication. For example, while the different zones may serve slightly different demographic compositions, the experience gleaned from one's ground interactions is useful knowledge for the other Institutions.

MOVING FORWARD

Over the next few years, patients will expect a higher level of consistency in programmes across NHG Institutions such as Community Nursing, Community Health Posts (CHPs), and the various transitional programmes. They will also experience tighter cohesion with community resources as part of the community networks for seniors we are building across NHG's three zones. Our desire is to see patients experience the same standards and quality of care, and accessibility of service, regardless of where they live.

We will also work with Finance on bundling of care services and associated Funding Models. This will facilitate care provision to be more seamless, and ensure greater efficiency and productive use our resources, including manpower.

No single provider can do all this alone; We are grateful for the many partnerships that we have and common beliefs that we share. As one NHG, we will continue to strengthen communications with stakeholders to steer this journey in the years to come.

PROVIDING EVIDENCE FOR POPULATION HEALTH MANAGEMENT IN NHG

DR HENG BEE HOON, SENIOR DIRECTOR, HEALTH SERVICES AND OUTCOMES RESEARCH, NHG

Singapore has one of the fastest ageing populations in the world because of factors that include reduced child and adult mortality rates, increasing life expectancies, and declining fertility rates. This greying of the population brings with it an increased prevalence of chronic and degenerative diseases, and therefore, rising healthcare costs. Government expenditure on healthcare rose from $4 billion in 2010 to $10 billion in 2018, and is expected to increase further to $13b in 2020[1]. We, therefore, urgently need new models of care to manage this disease burden trajectory and keep healthcare sustainable.

NHG's Health Services and Outcomes Research (HSOR) Department provides evidence and data for the planning and evaluation of interventions. It uses primary and secondary research methodologies and designs, carries out analyses of large data sets from registries and routine administrative databases, and utilises modelling and simulations to predict and forecast various "what-if" scenarios in order to support NHG's initiatives in population health management.

WHY POPULATION HEALTH?

The disease burden of a country is measured by Disability-Adjusted Life Year (DALY), which is the sum of the Years of Life Lost (YLL) due to premature death and Years Lost due to Disability (YLD). In Singapore, the DALYs of non-communicable diseases, such as cardiovascular disease and stroke, have been steadily increasing. The risk factors that drive most of these deaths and disabilities are modifiable, and include[2]:

- Dietary Risks
- Tobacco
- High Blood Pressure
- High Fasting Plasma Glucose
- High Body Mass Index (BMI)
- High LDL-Cholesterol

The progression of our population's health, or ill health, primarily stems from **Lifestyle Choices** and the associated risk factors. If poorly managed, these risks lead to **Chronic Diseases**, which in turn lead to complications, disabilities, and **Frailty**. There is therefore a need to go upstream, with data collection and targeted interventions, to manage our population's health so that a majority can avoid this largely preventable trajectory.

Lifestyle Choices → **Chronic Diseases** → **Frailty and Disabilty**

WHAT DOES THE DATA TELL US?

High Prevalence of Overweight and Obesity Tied to High Risk of Developing Diabetes

- In the Central Region, a 2017 population-based health survey of 1,942 respondents, aged 21 and above, found that the prevalence of overweight and obesity (BMI≥25 kg/m^2) followed closely that of the Singapore population – 44 per cent of males and 32 per cent of females.
- Data from NHG's Chronic Disease Management System allowed for the regression analysis of about 22,000 patients followed over six years, which found that being overweight and obese were the strongest and most significant predictors for developing diabetes (*see Table 1*), followed by ethnicity and gender.

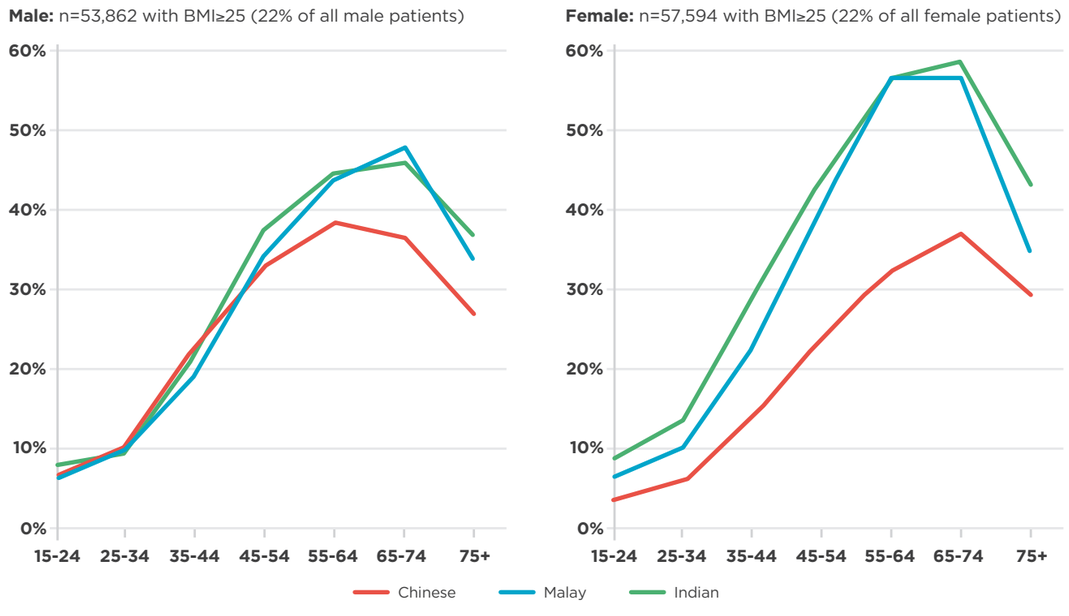
[1]Singapore Budget 2018
[2]www.healthdata.org/singapore

Table 1: Significant Predictors Of Developing Diabetes

	Predictor	Risk Of Diabetes In 6 Year Period
WHO BMI category	Normal (BMI<25) Overweight (25≥BMI<30) Obese (BMI≥30)	1 (reference) 1.8 times 3.0 times
Ethnic group	Chinese Malay Indian	1 (reference) 1.3 times 1.5 times
Gender	Female Male	1 (reference) 1.2 times

- About 22 per cent of over 110,000 patients who attended our polyclinics in 2017 were overweight and obese with observable gender and ethnic differences (*see Figure 1*). These patients can be an "opportunistic" population for close surveillance, early screening, and detection for early interventions that can prevent them from developing chronic diseases.

Figure 1: Number of NHGP Patients with BMI≥25 kg/m^2 (2017)



Patients are Diagnosed Late

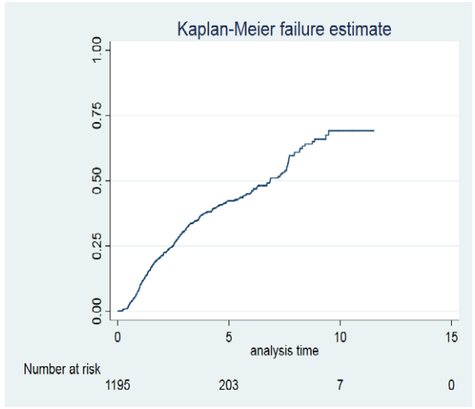
- About half of patients with no previous encounters in NHG with newly diagnosed hypertension, presented for the first time at the Emergency Department (ED) with serious complications, such as stroke (including transient ischaemic attack), chest pain, ischaemic heart, and hypertensive heart diseases. Yet, first presentations with serious complications are preventable with early detection and optimal management of risk factors.

Pre-Diabetes Must Be Controlled

- Among newly diagnosed persons with pre-diabetes, the average annual rate of transition to diabetes is 11%. In 10 years, almost 70% had developed diabetes (*see Figure 2*).
- The Central Region had a total of over 25,000 persons with pre-diabetes at the end of 2017. They are closely monitored for progression to diabetes.

Figure 2: Progression Rate of Pre-Diabetes to Diabetes (NHGP, 2005-2017)

69% progressed to Diabetes Mellitus in 10 years
Annual progression rate: 11.2% (CI 10.1%-12.4%)



Prevalence of Pre-Diabetes in Central Region known to NHG (as at 31 Dec 2017)	
Impaired Fasting Glucose (IFG) only	15,799
Impaired Glucose Tolerance (IGT) only	783
IFG and IGT	8,705
Total Pre-diabetes	**25,287**

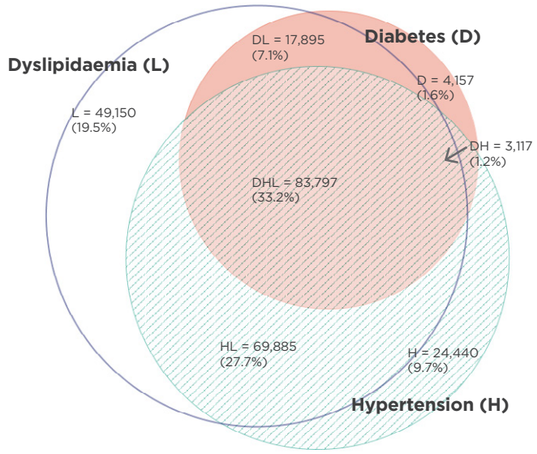
Chronic Diseases Must Be Well Managed to Prevent Serious Complications

- **D**iabetes (D), **H**ypertension (H), and dys**L**ipidaemia (L) are major risk factors for cardiovascular complications, the top cause of death in Singapore (YLL) (*see Table 2*). Between 2010 and 2017, over 252,000 patients have sought treatment for one or more of these conditions in NHG. The majority have co-occurrence of two or more conditions (*see Figure 3*), with L being the most prevalent condition followed by H and D.
- The prevalence of cardiovascular complications and its rate of progression increases with age and the presence of hypertension. Over half of all persons with DHL and over 40 per cent of persons with HL have complications, as shown:

Table 2: Top Causes of Death in Singapore

Cause of Death	% of Mortality
Cardiovascular risk factors and their complications (diabetes, hypertensive diseases, cerebrovascular diseases, ischaemic heart disease, kidney diseases)	34%
Cancer	29%
Pneumonia, urinary tract infection	22%

Figure 3: Concurrence of DHL (NHG, n= 252,448, 2010 - 2017)



Distribution of D, H, or L in NHG (n=252,448)		
Diabetes Mellitus (D)	108, 966	43.2%
Hypertension (H)	181, 239	71.8%
Dyslipidaemia (L)	220, 727	87.4%

*** 2010**

Table 3: Age, Complications Rate and Progression Rates to Complications*

	D only	L only	DL	H only	DH	HL	DHL
No. of patients	4,157	49,160	17,895	24,440	3,107	69,885	83,804
Mean age of patients (years)	54.4	58.0	57.2	60.8	64.3	66.7	67.6
% patients with complications	8.3%	13.0%	13.9%	16.8%	25.5%	41.4%	53.8%
Annual rate of progression to complications	1.0%	1.0%	1.8%	2.2%	4.6%	3.6%	6.3%

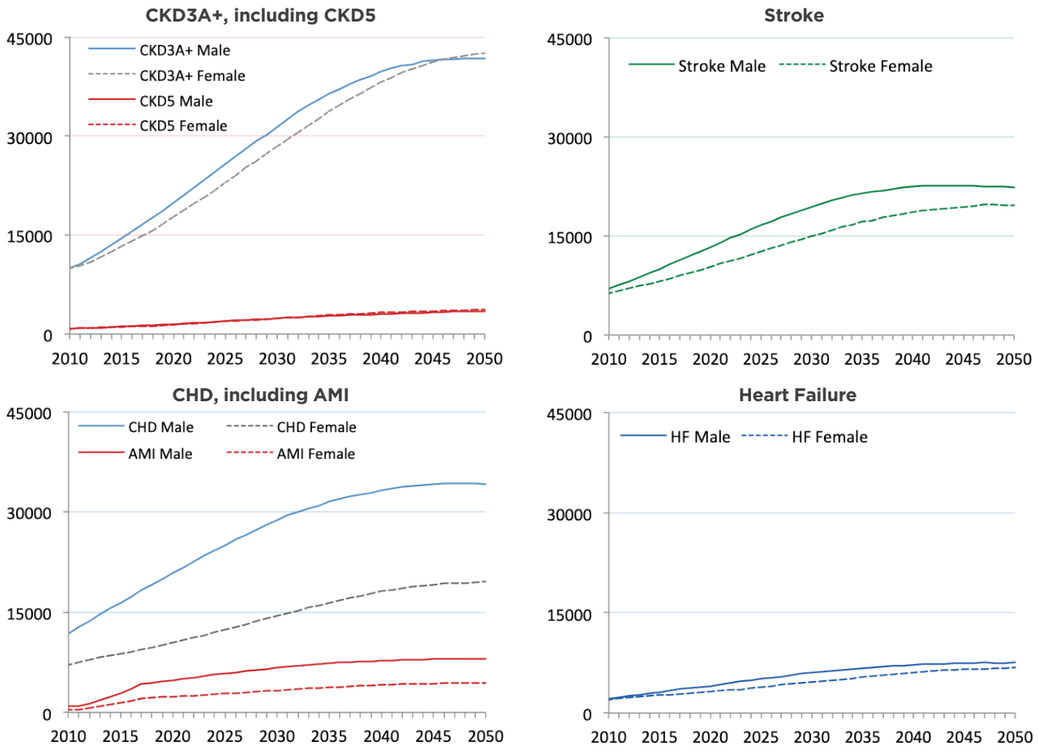
*** Coronary heart disease, cerebrovascular disease and chronic kidney disease 3A and above**

- The progression to cardiovascular complications similarly shows higher rates among persons with hypertension – at 6.3 per cent, 4.6 per cent, and 3.6 per cent in those with DHL, DH, and HL, respectively. The rate of transition in those without H was low in comparison (1 per cent - 1.8 per cent). There are also gender and ethnic differences in the rate of progression to complications (*see Table 4*).
- Microsimulation, assuming current transition rates, has projected that the burden of cardiovascular complications arising from D, H, and L in NHG will increase significantly by 2030 (*see Figure 4*).
- Overall, this translates to greater demand for healthcare services and cost to society as these complications are associated with functional disabilities and dependencies. Secondary prevention through good management of D/H/L is paramount to check the progression to complications.

Table 4: Gender and Ethnicity-Specific Rate of Progression to Cardiovascular Complications

		Male (No.)			Female (No.)			2017-30 Growth	
		2010	2017	2030	2010	2017	2030	Male	Female
CKD5	Chinese	637	1,051	2,049	654	895	1,863	1.95x	2.08x
	Malay	74	116	190	100	144	304	1.64x	2.11x
	Indian	60	97	143	51	91	195	1.47x	2.14x
CHD	Chinese	9,528	14,871	23,212	5,817	7,601	11,258	1.56x	1.48x
	Malay	757	1,258	1,953	496	719	1,242	1.55x	1.73x
	Indian	1,438	2,194	3,568	739	1,074	1,935	1.63x	1.80x
Stroke	Chinese	6,214	9,895	16,777	5,627	7,952	13,221	1.70x	1.66x
	Malay	327	611	1,038	326	516	784	1.70x	1.52x
	Indian	481	790	1,524	316	538	981	1.93x	1.82x

Figure 4: Projected Cardiovascular Complications (Central Region, 2030, 2050)



CKD – Chronic Kidney Disease **CHD – Coronary Heart Disease** **AMI – Acute Myocardial Infarction**

A Rise in Persons with Frailty and Disabilities implies Need for Care Transformation

- Currently, there are about 45,000 patients with Frailty living in the Central Region. Data from our Population Health Index (PHI) study shows that:

  i. There is a correlation between multi-morbidity of chronic conditions and poor physical function.

  ii. The severity of Frailty is significantly associated with depressive symptoms among the elderly.

  iii. Functional dependence and cognition are closely related with dependent elderly having lower cognitive functioning compared with their independent peers.

  These findings highlight the need to improve the physical functioning of the elderly so that they can remain independent and physically active in the community and reduce their risk of mental decline.

- Persons with disabilities and Frailty, arising mainly from cardiovascular complications, cost five times more to care for than those without. The impending wave of the estimated one million baby boomers will impose high demand for healthcare services to manage chronic diseases and their complications. There is a pressing need for care and finance transformation for healthcare to remain effective and sustainable.

MEASURING POPULATION HEALTH

The NHG programmes that seek to improve health and other outcomes should result in a healthier population in the Central Region, and in Singapore. Measurements of population health, therefore, span the spectrum – from individuals to programmes, and at regional, national, and global levels.

- At the **programme** level, researchers and implementers collaborate to embed evaluation plans into programmes at the planning and design stage. A variety of population health programmes and services which address the needs of Frequent Admitters (FAs), the elderly, chronic disease, mental health and End-of-Life patients measure effectiveness against identified goals and objectives. Outcomes in the clinical, quality of life, patient experience, and economic domains are assessed, and programmes are designed with the aim of generating valid, actionable, objective, and timely results.
- At the **regional** level, measuring the overall health of the population using a summary index such as the PHI enables longitudinal tracking of the general state of health in NHG's geographical catchment. Developed by NHG, the PHI captures the effects of various determinants of health – physical (chronic diseases, function, and disability), mental (dementia, cognition and depression), social (isolation and loneliness), and past healthcare utilisation. The PHI is also actionable based on the responses of the person by identifying the particular domains that contribute to his or her PHI score. In addition, public health metrics of morbidity (e.g. incidence and prevalence) also allow for epidemiological description of the extent of our disease burden, and for longitudinal trending, which enables an assessment of progression and trajectories.
- At the **national** level, the Ministry of Heath (MOH) monitors metrics such as Burden of Disease (through DALYs), a summary metric that allows for international comparison of the state of health between countries.

Through the systematic collection of relevant data and rigorous analyses at the programme and regional levels, HSOR provides and evaluates evidence that is necessary for the design of effective initiatives and programmes with the aim of continually improving population health.