Programmable manikins offer realistic scenarios for medical students to practise on.

Diabetes management programme reduces rate of diabetic kidney disease.
Let's Face It
3D Printers are helping reconstructive surgeons at the NUH

Family-Focused Healthcare
The NUH offers more services to families with diverse healthcare needs

Finding Nemo
A snappily named programme aims to help diabetics better manage their condition

A Pooh-fect Cure
Transplanting faecal matter from a healthy person into a patient is now an actual procedure

Real-time Cancer Diagnoses Now Possible
The In-Vivo Molecular Diagnostic System makes cancer diagnoses faster, simpler and more objective

Matters of the Heart
Heart Failure research gets a $10 million boost
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Where is the NUHS going? Is it headed in the right direction, and how do you know this? What is the advantage of bringing university medical, dental and public health schools together with a hospital?

The NUHS is making excellent progress in developing into a top-rate academic health system. Led first by Associate Professor Benjamin Ong and now by Professor John Eu-Li Wong, exciting and meaningful strategic
The NUHS benefits greatly from the Singapore system and brand. Most importantly, Singapore’s singular focus on talent provides the environment and support for nurturing high-potential Singaporean doctors, dentists, medical professionals and scientists.

Is this formulaic? What advantage does such a health system offer multicultural, multinational Singapore?

The academic health system plays a crucial role in positioning Singapore medicine for the future. We can think of it as a powerful platform that catalyses and enables the synergies necessary to achieve this. In the academic health system, when patients are cared for and public health studies are done on the multi-ethnic, multicultural Singaporean community, the research-intensive doctors and faculty of the health system gain important insights and identify major research questions.

These help inform the type of research that is carried out and facilitate the translation of laboratory research discoveries into improvements in diagnosis and treatment of patients, and enhancements in community health. At the same time, academic health systems place a high priority on education and provide a unique and stimulating learning environment for students.

How would universities such as the NUS fit into this calculation, if at all?

Successful biomedical and clinical research and education today rely on a much broader set of disciplinary expertise. Apart from the biomedical sciences, disciplines such as engineering, chemistry, materials science, behavioural and social sciences, mathematics and computing are often critical for understanding complex medical, dental and public health problems, and in devising innovative solutions and approaches to diagnosis and treatment.

The location of the NUHS right next to a leading research-intensive university with a full range of disciplinary expertise creates a distinctive and vibrant environment for the types of multidisciplinary collaborations necessary for real advances in research, education and patient care.

Singapore, though small geographically, is often lauded for its ability to successfully harness its strategic location to grow its international roles in trade, banking and finance, pharmaceuticals, to name a few key sectors. How do you see the NUHS similarly benefiting from Singapore’s strategic location and competitive strengths, and to what end?

The NUHS benefits greatly from the Singapore system and brand. Most importantly, Singapore’s singular focus on talent provides the environment and support for nurturing high-potential Singaporean doctors, dentists, medical professionals and scientists. At the same time, because Singapore is such an attractive country to live in, this helps the NUHS to attract and retain top talent from overseas, who contribute to the building up of our local capabilities.

Singapore’s small size also makes it relatively easier for local institutions to work together and coordinate their activities in order to attract and collaborate with industry partners.

The outcomes of all these include continually improving clinical care, higher impact research, even better education, and increased investments by industry into R&D and talent development in Singapore.
A CONTINUOUS SEARCH FOR SOLUTIONS
A chat with the Chief Executive of the NUHS, Professor John Eu-Li Wong.

What makes you smile when you talk about the NUHS?

Our staff, who are truly remarkable. They have one of the most difficult jobs in Singapore, working at all hours of the day and night, every day of the year.

We take good health for granted until something bad happens. When that occurs, and it can be catastrophic, we assume that the healthcare professionals treating us know their stuff. We expect them to be compassionate and empathetic, no matter what time it is, whether they are hungry, tired, feeling unwell themselves, or having problems at home. We expect our services and facilities to be spotless and work perfectly 24 hours a day, 365 days a year. We expect those who teach to inspire us every day. We expect our researchers to come up with major breakthroughs regularly. We expect a tremendous amount from our staff every day.

Singapore is blessed to have the people we have at the NUHS. Not many places in the world have public institutions that provide the quality of care, teaching and research at the budget we have.

What are the areas that you think the NUHS can do even better at?
We must do better in everything. The challenges Singapore faces are enormous and complex. No one will solve them for us. We have one of the fastest ageing populations in the world, with the accompanying exponential surge of chronic diseases. The average 60-year-old person has several chronic diseases simultaneously; worse, most do not take these seriously until complications occur. Couple this with a fertility rate so low that the only way we can replenish sufficient youth is through immigration. Put significant restrictions on immigration and we will have a labour shortage the likes of which we have never seen. Our economy is also slowing down as we mature. Healthcare productivity has not improved significantly over the last 20 years while healthcare costs continue to rise faster than the consumer price index.

We need to continuously improve the quality of what we do, be it patient care, teaching, or searching for solutions, because Singaporeans expect that of us. Yet we have to do this with either the same manpower budget or ever better with less, with either the same budget or at a rate of increase in line with inflation.

What are new areas of expertise that the NUHS could establish itself in as a thought and practice leader?

We are using our unique strengths as an academic health system to develop better, more effective and more sustainable ways to prevent, screen, manage and rehabilitate patients with chronic diseases to benefit the whole of Singapore. We will use our Regional Health System and all our partners in public and private sector primary care, community hospitals, nursing homes, voluntary welfare organisations, non-government organisations, Foundations, Ministries and industry to test new models of care for scalability across Singapore.

We will develop novel programmes to keep the population as functional as possible so that the aged can continue to enjoy life with their family and friends at home. How long patients stay out of hospital with the highest quality of life in a safe environment should be what we aim for. This calls for novel ways to tackle issues—cognitive impairment, mental health, vision, hearing, mobility, nutrition, and how we maintain our immune system.

What’s your wish for the NUHS? What would you like Singaporeans, Asia, the world, to say about the NUHS, five, 10 years from today?

My wish for the NUHS is that we stand proud of what we have accomplished in healthcare, research and education. To give Singaporeans from all sectors of society quality, accessible and affordable healthcare every day at any hour is something very few public institutions globally can do consistently. To develop solutions for Singapore’s healthcare challenges that benefit not only Singapore, but also other places, will result in a much better world. To train future-ready, world-class healthcare professionals will create a legacy that will remain long after we have gone.

I would like Singaporeans to say that Singapore would not be what it is if not for the NUHS. I would like Asia and the world to say, “Wow!” when they think of the NUHS. We have, and will, continue to shape medicine for the future of Singapore.
AT THE HELM

Creating opportunities, exploring synergies.

1. **MR TAN CHONG MENG**
   Board Member
   Group CEO, PSA International Pte Ltd

2. **MR ANTHONY TAN**
   Board Member
   Deputy Secretary (Policy), Ministry of Health

3. **MS WU CHOY PENG**
   Board Member
   Group Chief Information Officer, SingTel

4. **MR SANJIV MISRA**
   Board Member
   President, Phoenix Advisers Pte Ltd

5. **MR PATRICK DANIEL**
   Board Member
   Editor-In-Chief, English and Malay Newspaper Division (EMND), Singapore Press Holdings Ltd

6. **MRS TAN CHING YEE**
   Board Member
   Permanent Secretary (Health), Ministry of Health

7. **PROFESSOR TAN CHORH CHUAN**
   Chairman NUHS Board
   President, National University of Singapore
MR LIM HOCK SAN
Board Member
President & CEO
United Industrial Corporation Ltd and
Singapore Land Ltd

MS KWA KIM LI
Board Member
Managing Partner, Lee & Lee (Advocates
& Solicitors), Singapore

MR RICHARD LIM
Board Member
Chairman, ST Logistics Pte Ltd

DR JOHN CHEN SEOW PHUN
Board Member
Chairman, SAC Capital Pte Ltd
Managing Director, JCL Business
Development Pte Ltd

MRS SYLVIA LEE
Board Member
Director, Corporate Development,
ACTSYS Process Management
Consultants Pte Ltd

MR PHILIP SU POON GHEE
Board Member
Executive Director, Far East Organization

MR NICKY TAN NG KUANG
Board Member
CEO, nTan Corporate Advisory Pte Ltd

PROFESSOR TECK HUA HO
Board Member
Vice President (Research Strategy)
National University of Singapore
KEEPING ON TRACK
Leading the NUHS to shape medicine for Singapore’s future.

PROFESSOR JOHN EU-LI WONG
Chief Executive, National University Health System

Professor John Eu-Li Wong, Isabel Chan Professor in Medical Sciences, is Chief Executive of the National University Health System, and Senior Vice President (Health Affairs) at the NUS.

A medical oncologist-haematologist, Prof Wong obtained his MBBS from the NUS and did his residency and fellowship at the New York Hospital-Cornell Medical Center, where he was the Chief Resident in Medicine, and Memorial Sloan-Kettering Cancer Center.

He is actively involved in the development of Biomedical Sciences as a key pillar of Singapore’s economy, as well as the development of Singapore’s first academic health system linking the National University Hospital and the NUS’ medical, public health, dental and nursing schools under one unified governance.

Prof Wong represents Singapore in the M8 Alliance of Academic Health Centers and the Association of Academic Health Centers – International. He is currently a member of the World Economic Forum’s Global Agenda Council on Personalized and Precision Medicine, the Nature Index Panel of Senior Medical Advisors, the International Editorial Board of the American Journal of Medicine, and the Editorial Board of the Journal of the American Medical Association.

ASSOCIATE PROFESSOR YEOH KHAY GUAN
Deputy Chief Executive, National University Health System
Dean, NUS Yong Loo Lin School of Medicine

A gastroenterologist by training, Associate Professor Yeah Khay Guan is Dean of the NUS Yong Loo Lin School of Medicine. He is Associate Professor at the Department of Medicine, NUS, and Senior Consultant with the Department of Gastroenterology, National University Hospital.

A/Prof Yeah’s research interest is in the early detection of gastric and colorectal cancers, and he has published more than 100 peer-reviewed papers in international journals. He is the Lead Principal Investigator of the Singapore Gastric Cancer Consortium, a national flagship research group that aims to improve the survival outcomes for gastric cancer in Singapore. A/Prof Yeah also chairs the National Colorectal Cancer Screening Committee of the Health Promotion Board, Ministry of Health, which recommends guidelines for the national colorectal screening programme in Singapore.

ADJUNCT ASSOCIATE PROFESSOR JOE SIM
Chief Executive Officer, National University Hospital

Adjunct Associate Professor Joe Sim is the Chief Executive Officer of the National University Hospital. He is responsible for running the 1,192-bed tertiary hospital to fulfil its public sector mission of providing cost-effective and accessible care with excellent outcomes. He is also responsible for setting the strategic direction and overseeing the development of the academic mission at the NUH as part of the NUHS.

As an Adjunct Associate Professor with the NUS Yong Loo Lin School of Medicine, NUS Saw Swee Hock School of Public Health and NUS Business School, he takes on the academic challenge of sharing his knowledge and experience in health administration with students in these two faculties.

He is a member of the Ngee Ann Polytechnic Council as well as a Board Member of the Singapore Workforce Development Agency and the Urban Redevelopment Authority. Adjunct A/Prof Sim won The Singapore HR Awards’ Leading CEO Award in 2014.
ASSOCIATE PROFESSOR AYMERIC LIM
Chairman, Medical Board, National University Hospital

Associate Professor Aymeric Lim is the Chairman of the Medical Board (CMB) of the National University Hospital and oversees the professional standards of clinical care services at the hospital. He is a surgeon who specialises in Hand and Reconstructive Microsurgery and has research interests in free flaps, nerve and brachial plexus surgery as well as tendon transfers. His research is in the area of intra-muscular innervation of the forearm muscles.

ASSOCIATE PROFESSOR GRACE ONG
Dean, NUS Faculty of Dentistry

Associate Professor Ong is a periodontist and also Head and Senior Consultant, Department of Preventive Dentistry, and Chair, Dental Cluster National University Health System.

Her involvement in dental education extends beyond the Faculty. She is Consultant, Peer Review group of the SEA Association of Dental Education and was also a member of the DentEd group, a European consortium of dental schools.

Her research interests are in the epidemiology and microbiology of periodontal disease. Recently, she has started looking at teaching and learning outcomes.

PROFESSOR CHIA KEE SENG
Dean, NUS Saw Swee Hock School of Public Health

Professor Chia is Dean of NUS Saw Swee Hock School of Public Health and the Director of the Centre for Molecular Epidemiology. He is also an Adjunct Professor of Epidemiology at the Karolinska Institutet, Sweden.

He started his professional career as an occupational medicine specialist and is currently a member of the Workplace Safety and Health Council, chairs the Workplace Health Committee and is a member of the WSH Institute Steering Committee.

His current research focus is in the molecular epidemiology of chronic diseases (cancer, cardiovascular disease, myopia and diabetes mellitus) and the translation of these findings to preventive measures at the population level. In the last five years, Prof Chia has set up the Singapore Consortium of Cohort Studies for translational research to elucidate gene-environment interactions in disease causation, prevention and therapy.
TARGETED, TIMELY RADIATION

The Radiation Therapy Centre at the National University Cancer Institute, Singapore, is the first in Southeast Asia to offer Accelerated Partial Breast Irradiation, a new convenient treatment that offers early stage breast cancer patients new hope.

In women with early stage breast cancer who have undergone breast-conserving surgery, adjuvant radiation therapy remains the standard of care, resulting in better local control as well as survival rate. The use of mammographic screening has enabled early identification of women with early stage breast cancer, increasing breast conservation rates in this group of women.

However, the use of conventional fractionation radiation therapy given over a period of five to six weeks may pose a barrier to patients, leading some women to opt for total mastectomy instead. To avoid unnecessary total mastectomies, Accelerated Partial Breast Irradiation (APBI) is a viable alternative radiation therapy modality for these women, given its shorter overall treatment duration of five treatment days. This makes it more convenient for patients who are economically active and find it difficult to take time off work; it also suits patients who need to travel long distances for their radiation therapy treatment.

Since APBI was first offered in 2007 at the Radiation Therapy Centre (RTC) of the National University Cancer Institute, Singapore (NCIS), breast conservation treatment has become a viable alternative for women who would otherwise opt for total mastectomies.

There are many different APBI modalities: intraoperative, mammosite, multicatheter and external beam. At the NCIS, multicatheter APBI is...
As part of the relocation of the NCIS to the NUH Medical Centre, the RTC was relocated from the Kent Ridge Wing to the new Yong Siew Yoon Wing in February this year. The move also saw the centre’s facilities expanding to accommodate more patients. Overall, it now has a generous floor space of 2,500m², up from 2,200m² in the old wing. Five consultation rooms have been added, making a total of 10 consultation rooms available. A spacious common area and three smaller sub-waiting areas are designated for patients and their accompanying caregivers to wait in comfort. Imaging facilities have also been given an upgrade, with the addition of a dedicated MRI Simulation Room and a PET/CT Simulation Room.

The NCIS has planned ahead and included an extra room in the centre for future expansion. There is also room for three more Linear Accelerator machines, in addition to the three already installed. These machines deliver external-beam radiation therapy.

Moreover, APBI also has an impact on treatments following radiation therapy. The entire cancer treatment protocol is speeded up as patients can immediately proceed with chemotherapy and hormonal treatment as the APBI treatment is over in five days instead of 42. Patients eligible for APBI include:

- patients above 40 years of age
- patients with clear surgical margins on histopathology
- patients with tumour diameters 3cm-wide or smaller
- node negative patients

More than 100 patients—both local and from overseas—have undergone APBI at the RTC so far, a record for any medical institution in Southeast Asia. Clinical outcomes for the cases have been presented and published, and have shown to be favourable and comparable to major health institutions in the USA and Europe. Favourable outcomes include fewer side effects such as less radiation in the lungs, heart, ribs and lymphatics, as well as better cosmetic effects.

Apart from being the first medical institution in Singapore and Southeast Asia to offer this treatment, the NCIS is also the preferred institution in Southeast Asia for APBI training. With this new APBI treatment capability, patients are now given a new lease of hope in the fight against early stage breast cancer at the NCIS.
HEART OF THE MATTER

Since May 2013, the National University Heart Centre, Singapore (NUHCS), has been using the new Hansen Sensei-X Robotic Catheter System to treat patients with heart rhythm disorders, or arrhythmias. The conventional method of treating arrhythmias involves manually inserting a catheter into the heart to deliver heat to the heart muscle. The application of heat, known as ablation, prevents abnormal electrical activity in the pulmonary veins from disrupting the heart rhythm.

The Hansen Sensei-X system increases the safety and precision of the procedure, thanks to the robotic catheter, which can reach inaccessible areas of the heart to administer ablation. The system also comes with 3D mapping, which provides an accurate, real-time look at the heart, and a specially designed joystick, which gives the doctor using the system a high degree of control and dexterity.

TICKING BOMB DEFUSED

A man with an extremely rare heart infection avoided certain death, thanks to the resourcefulness and expertise of a team of doctors from the National University Health System (NUHS).

In May 2013, the 52-year-old patient checked into the National University Hospital, complaining of chest pains and dizzy spells. Doctors suspected a heart attack, but eliminated that possibility after examining his coronary arteries. Numerous blood tests later, cardiologists Dr Pipin Kojodjaj and Dr William Kong, and infectious disease specialist Dr Nares Smitasin, surmised that he had been infected by a bacteria typically found in the gut and female genital tract. Then a CT scan found an abscess in the patient’s myocardium. The last time something like this was reported was back in 1981. The doctors put the patient on antibiotics, which shrank the abscess, but created a cavity in the centre of the heart.

The case fell to Associate Professor Theodoros Kofidis, Head of the Division of Adult Cardiac Surgery, Department of Cardiac, Thoracic and Vascular Surgery at the National University Heart Centre, Singapore. “The cavity became like a balloon within the heart muscle that threatened to burst,” the surgeon recalls. Surgery became imperative to save the man’s life.

A/Prof Kofidis managed to patch the cavity in a two-and-a-half hour operation, but discovered something more unnerving: the patient’s heart had already ruptured! “This poor gentleman had another 24 hours to live—that’s it,” he stresses.

The surgeon stitched up the hole and used the sac of a cow’s heart to reinforce the repairs. So successful was the procedure that the patient was healthy enough to go home by July. “It was now or never,” A/Prof Kofidis says of the procedure. “If I didn’t do anything, he’s 100% dead. It was a ticking bomb.”
Preventing Infections Via...

**...SINGLE-USE DISPOSABLE WASTE RECEPTACLES**

The National University Hospital (NUH) has, since Mar 2014, replaced all its reusable bedpans, portable urinals and vomit bowls with disposable versions, which are discarded after a single use, thus saving time and ensuring greater hygiene in the wards.

To discard these new receptacles, which are made of paper pulp, nurses simply place them in a ‘macerator,’ a machine that uses cold water to shred the receptacles and then flushes them away. The new system halves the time nurses used to need for cleaning duties, which could take up to four hours per day. Nurses will now have more time with patients, says Senior Staff Nurse Moe Oo Khin.

Furthermore, the single-use disposable items prevent bad smells and the spread of bacteria such as the diarrhoea-causing *Clostridium difficile*, a thorn in the side of many healthcare facilities. As these bacteria are present in faeces, single-use bedpans will help reduce infection, particularly among the elderly and seriously ill, says Mrs Lee Siu Yin, the former Director of Nursing at the NUH.

**...NO-TOUCH AUTOMATED DISINFECTION TECHNOLOGY**

In addition, the NUH has invested in another technology that will curb the spread of infections among its patients.

Currently, the rate of infection for Methicillin-resistant *Staphylococcus aureus* (MRSA) among NUH patients is 2.5%, according to Associate Professor Dale Fisher, Head and Senior Consultant, Division of Infectious Diseases at the NUH. Treating such superbugs is costly and requires powerful drugs.

To lower that rate, the NUH now uses a technology that fumigates a sealed room with hydrogen peroxide vapour, which kills germs more effectively than the current practice of manual cleaning. According to the hospital, this enables hard-to-reach corners and commonly overlooked objects—such as television remote controls—to be thoroughly cleaned, thus ensuring an almost 100% germ-free environment.

The NUH’s intensive care units and isolation rooms, where patients with infectious diseases are warded, are the first areas to benefit from the fumigation technology.
HEALTH MANAGEMENT

HEALTHCARE WHERE IT’S NEEDED

THE NATIONAL UNIVERSITY HEALTH SYSTEM (NUHS) is revolutionising healthcare delivery for people living in the west of Singapore. As a regional health system, the NUHS integrates quality healthcare into the community in a way that is appropriate, affordable and convenient. This is done by providing for seamless transitions between healthcare settings with the system delivering care as and when the individual needs it. This will allow a shift from looking after patients as they present to looking after the health of the population.

A key component of this system is the Frontier Family Medicine Clinic (FMC), the first FMC of its kind to be set up in Singapore. Located in Clementi, it is a partnership between the NUHS and Frontier Healthcare Group. The clinic has the capability to care for patients with chronic conditions such as diabetes and hypertension, and accepts walk-in patients as well as those referred by the National University Hospital (NUH). In addition, patients under the Ministry of Health’s Community Health Assist Scheme (CHAS) can receive subsidies, while others can use their Medisave.

The idea is to deliver the right care to patients at the right place and time. Those whose conditions have stabilised are referred to Frontier FMC, where family physicians at the FMC take personal responsibility for the patients under their care, coordinating care and providing primary care needs even when patients are seen by specialists. “We know that the majority of care doesn’t necessarily exist in a hospital. A lot of it should be carried out where the individual lives and works,” notes the then-Chief Executive of the NUHS, Associate Professor Benjamin Ong.

Collaboration and communication are needed to integrate healthcare efficiently. At Frontier FMC, family physicians and staff—comprising case manager, care coordinators, nursing and allied health practitioners—work closely with their NUH specialist colleagues to monitor patients’ progress. If necessary, physicians would refer them back to specialists for additional treatment required. This patient referral and shared care process is greatly enhanced by the sharing of electronic medical records between the NUH clinicians and the FMC family physicians. “The doctor attending to me there is very attentive, and he has ready access to the medical history I have with NUH,” says Mr Sung Chu, a patient at Frontier FMC.

Together, the NUHS and Frontier FMC are providing better care than ever before, serving the patients’ healthcare needs as and when they are needed.

As a gauge of the scheme’s success, 1,200 NUH patients were referred to Frontier FMC in the first year of operations. Not resting on its laurels, the NUHS remains committed to further improve the quality of life for all Singaporeans. Plans are underway to expand its regional health system infrastructure to integrate care, including more FMCs, polyclinics, a community hospital and nursing homes, as well as GP networks across the region. “Ultimately, quality of life is what we’re aiming for; being able to get back to your friends and family,” says A/Prof Ong.

We know that the majority of care doesn’t necessarily exist in a hospital. A lot of it should be carried out where the individual lives and works.
The invention of the wheel made possible the development of the car. Yet, wheeling conventional hospital beds through the labyrinth of corridors today is still a laborious process that requires at least two healthcare workers.

Recognised as a core facility within the National University Health System (NUHS) and the NUS community, the Medical Engineering Research & Commercialization Initiative (MERCI) aims to develop and commercialise products that address clinical and hospital needs, including, in this case, a revamped wheel system to improve productivity.

Known as SESTO, this motorised add-on module comprises a touch-sensitive control panel and a corresponding automated mobility wheel attached under the bed. SESTO is compatible with any hospital bed and allows just a single healthcare worker to move the bed in any direction instantaneously, saving time and manpower—precious resources when critical cases arise.

Born out of a collaboration between the NUS and local engineering firm HOPE Technik, a SESTO prototype was tested in the NUH in November last year. The SESTO marks the first of several projects that MERCI is undertaking to improve hospital productivity.

MERCI continues to be a hub of technological innovation and has secured six competitive grants totalling $1.9 million in the past 12 months. This funding will enable MERCI to focus product development efforts on projects ranging from minimally invasive devices to medical sensors.

Patient care and staff productivity were given a boost by recent IT projects introduced by the Integrated Health Information Systems.

One project was the expansion of the Clinical Documentation (C-Doc) system, which combines various databases for a comprehensive compilation of patients’ medical information. Additional databases such as laboratory and radiology investigation orders were integrated into C-Doc last year. Outpatient medication orders will be entered into this archive this year.

Sharing of vital patient information was also made easier. Rolled out in Jul 2013, the Specialist Results System electronically records medical examination results. It permits staff at specialist outpatient clinics and service providers to review these results alongside data fed in from other systems.

Furthermore, a new IT system was also designed for the first National University Health System Family Medicine Clinic, which opened in Apr 2013. The system is linked to electronic medical records, allowing doctors on both ends to coordinate patient care accordingly.

Other initiatives on the clinic floor were designed to more efficiently deliver patient services. A new queue system, implemented at the NUH Medical Centre in Oct 2013, reduces waiting time by issuing a single queue number to patients who have various appointments within a clinic for the day. Self-registration kiosks were also set up at all clinics to reduce staff workload.

Patient Care 2.0

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A TWO-IN-ONE THAT’S THE BEST OF BOTH WORLDS

Apart from bypass and angioplasty procedures, patients with multiple blocked heart arteries may opt for a new hybrid approach to heart surgery that is less invasive and lets them recover more quickly.

HEALTH MANAGEMENT

Schaemic heart disease, better known as coronary artery disease, was responsible for about 16% of all deaths in Singapore in 2012, according to the Ministry of Health.

When it comes to treating coronary artery disease, doctors have long had only two options. The first is bypass surgery, in which a new artery is created to bypass a blocked one. The second is angioplasty, in which a stent/scaffold is inserted into the site of the blockage to keep the artery open with the help of an inflatable balloon.

But there is now a third way. The National University Heart Centre, Singapore (NUHCS), has introduced a procedure in which cardiologists and cardiothoracic

HOW IT WORKS

WHAT IT IS: Two procedures, a heart bypass and an angioplasty, are performed concurrently.

HOW IT IS DONE: A bypass, in which a new artery is created to sidestep a blocked one, is usually done first. The left internal mammary artery, a blood vessel inside the chest cavity, is attached to the left anterior descending artery. This is followed by an angioplasty for the other suitable arteries—the right coronary artery and left circumflex branch—which involves inserting stents to keep them open.

ADVANTAGES: Only a small incision (6cm to 8cm) on the left side of the body is needed, so the patient recovers faster.
surgeons use a unique one-stop hybrid approach that combines the best of the two current methods. Known as the hybrid revascularisation bypass procedure, this method has cardiologists and cardiothoracic surgeons working together, where a heart bypass and angioplasty surgery are performed concurrently. That way, instead of undergoing surgery on two separate occasions, the patient goes under the knife only once.

Another significant benefit is that patients recover more quickly from the hybrid approach. This is because conventional bypass surgeries require doctors to break apart the breastbone, a process known as a full median sternotomy, to gain access to the heart. This highly invasive process can leave behind a scar between 15cm and 20cm long on the patient’s chest, not to mention the potential risks involved. Moreover, according to Associate Professor Theodoros Kofidis, Head of the Adult Cardiac Surgery Division in the Department of Cardiac, Thoracic & Vascular Surgery at the NUHCS, some patients may require supplementary stenting, or reopening of blocked bypasses because of technical issues that crop up during the operation. This makes coronary artery disease a particularly tricky condition to treat.

The procedure removes completely the need for a full median sternotomy. It only requires a small incision of about 6cm to 8cm on the left side of the body. Since the one-stop hybrid approach involves cutting through soft tissues and muscles instead of sawing through bones, patients are usually discharged within four days as opposed to the usual week-long stays.

Aside from shorter hospital stays, a study of 45 patients published in The Journal of Thoracic and Cardiovascular Surgery in 2008 confirmed that patients who go through the hybrid approach required fewer blood transfusions compared to those who had a sternotomy done. Further studies have also shown that traditional heart bypass surgeries, which involve reconstructing new arteries from leg veins, may not be always durable. In fact, up to 60% of vein grafts harvested from the leg and 30% of grafts made with radial arteries develop blockages after a decade. “Most times, the hybrid approach provides the patients with a left internal mammary artery bypass to the left anterior descending artery, which has been shown to be very durable and effective in patients with ischaemic heart disease, combined with the use of drug-eluting stents in the rest of the arteries,” says Dr Edgar Toy, Cardiologist, Department of Cardiology at the NUHCS.

Despite the documented benefits of the hybrid revascularisation bypass procedure, this type of surgery is not widely practised beyond the NUHCS. This is due to the need for combined expertise, coordination and hybrid operating room facilities required in this type of surgery, not to mention its inherent cost: an average three-stent angioplasty with a day’s stay in a C-class ward costs between $4,500 and $6,600; at the NUHCS, the new procedure and a three-to-five-day hospital stay costs between $7,000 and $9,000.

The team at the NUHCS hopes that, with better-trained doctors in the long run, costs can be lowered dramatically, thus making this life-saving procedure a realistic and practical option for more coronary artery disease patients in Singapore. The NUHCS would also evaluate the long-term effectiveness of patients treated with this strategy.

Since the one-stop hybrid approach involves cutting through soft tissues and muscles instead of sawing through bones, patients are usually discharged within four days as opposed to the usual week-long stays.
A KINDER CUT

LUNG CANCER CONTINUES to rank among the top three cancers diagnosed in men and women in Singapore. Discovered early, it can be excised via lobectomy, the process of opening the chest to remove cancerous lung tissue and lymph nodes.

Introduced in the 1990s, video-assisted thoracoscopic (VATS) lobectomy is a minimally invasive technique developed to reduce post-operative pain in patients. Where surgeons may previously have had to cut through muscle and bone in traditional open surgery, they now need to make only three to five incisions through which a tiny camera and other surgical instruments are inserted to get to the diseased tissue. Despite these improvements, patients still take about a month before they can resume normal activities.

Concerned about the pain patients suffer after conventional VATS operations, Dr John Tam, Head of Thoracic Surgery at the National University Heart Centre, Singapore (NUHCS), set out to refine the VATS technique.

In 2009, he made a breakthrough using a single three-centimetre incision that became the world’s first uniportal VATS (UVATS) lobectomy. “The single-port access method means we only make one small cut, and all the muscle tissue and ribs are totally spared,” says Dr Tam. With UVATS, patients resume regular activities within a week and are almost pain-free, needing only oral analgesia to relieve mild pain. “When I regained consciousness after surgery, I was surprised that I could stand up and walk right away. I didn’t take any painkiller, and I didn’t expect to be discharged so quickly,” recounts a patient, Mr Cheong Yip Chong. He was one of Dr Tam’s patients to undergo the UVATS lobectomy three years ago.

Because of better recovery rates, Dr Tam could now reach out to older and weaker patients who would not have qualified for surgery before. He has since helped more than 350 patients, many of whom are in their 60s and 70s. The oldest is nearly 87 and made a successful recovery.

Dr Tam is eager to promote the use of the technique he developed and has taken to teaching others how to perform it—fewer than five surgeons in the world have adopted the single-incision method. The NUHCS is a world leader in this latest technique, being one of only two centres in the world that routinely offers UVATS to lung surgery patients.

Minimising risk, however, is still the main priority in surgery. If a lung tumour is too large, using the single-incision technique may not be appropriate. In that case, Dr Tam would opt for traditional methods. “The ultimate goal is to do a safe and good operation while optimising the patient’s recovery,” Dr Tam stresses.
Two-ProNged Approach

Since its move to the Yong Siew Yoon Wing of the NUH Medical Centre, the NCIS has made Surgical Oncology (SO) available in stages. Lung and gynaecologic oncology sessions were the first to be held there, while those for musculoskeletal oncology patients began in Oct 2013. Gastrointestinal cancer surgeons got in on the action in Dec 2013.

To provide a more holistic kind of care for cancer patients, the Medical Oncology (MO) team began in Mar 2014 to hold sessions for patients visiting for the first time. These sessions are tumour-specific, so the MO team is currently only seeing people with breast and gastrointestinal cancers.

In order for patients to get appointments in a timely manner, there are plans to create more first-visit slots, especially for SO patients. There are also plans for the NCIS to have its own call centre to handle appointments for some surgical disciplines (for colorectal cancer patients, for example).

CANCer HUB expands

The National University Cancer Institute, Singapore (NCIS), moved most of its facilities (Breast Care Centre, Viva-University Children’s Cancer Centre, Stem Cell Therapy Centre, Chemotherapy Centre, Cancer Centre) into its current premises in the Yong Siew Yoon Wing of the NUH Medical Centre in Aug 2013. The relocation of the Radiation Therapy Centre (RTC) there in Feb 2014 completed the move. With the shift, the net floor area of NCIS increased from 3,839m² to 7,550m². There are now 66 consultation rooms across Levels 8, 9 and 10 of the Yong Siew Yoon Wing.

The Viva-University Children’s Cancer Centre has also expanded (550m² from 320m²) to serve more patients, the adult Chemotherapy Centre now has 44 treatment chairs, while the RTC is larger (2,500m² from 2,200m²). There is also a dedicated space for Surgical Oncology (see below), where patients are attended by a multidisciplinary team consisting of surgeons, oncologists, nurse clinicians and therapists.

Yong Loo Lin Trust’s $25M Gift for NCIS

The NCIS facilities in the NUH Medical Centre is also known as the Yong Siew Yoon Wing, named after a daughter of Dr Yong Loo Lin, the physician-turned-businessman who created the Yong Loo Lin Trust. In 2013, the Trust gifted $25 million to the NCIS to collaborate with the Yong Loo Lin School of Medicine in the NUS. The Singapore government will match that gift dollar-for-dollar. “Yet another transformational gift from the Yong Loo Lin Trust,” is how Professor Tan Chorh Chuan, the NUS President, describes the gesture.

The $25 million will enable clinicians and clinician-scientists in the NCIS to work with relevant counterparts in and beyond Singapore to find cost-effective treatments for cancer patients here. The donation will also provide seed funding for research focused on cancer-related problems afflicting Asians.

This is timely as cancer is the leading cause of death among Singaporeans. “Almost 52,000 new cases were diagnosed among Singapore residents between 2006 and 2010,” reveals Professor John Wong, Chief Executive of the National University Health System and former Director of the NCIS. “We need to develop better ways to prevent, screen, diagnose and treat cancer through research and education. We cannot expect other countries to develop solutions for our problems.”

So far, the endowed portion of the $25 million has gone towards supporting two awards under the Yong Siew Yoon Fellowship, the hosting of a Visiting Professorship, as well as five research proposals.
A NEW 3D PRINTER is helping reconstructive surgeons at the National University Hospital (NUH) achieve better surgical results. Introduced to the cranio-maxillofacial surgery team in Jan 2013, it creates 3D replicas of patients’ skulls for more precise shaping of reconstructions and implants.

Since 2008, surgeons have been using virtual 3D skulls created by computer software to guide pre-operative planning as well as the actual surgery. CT scans of the injured skull contribute base images to create a model. The programme then reflects the undamaged facial parts onto the missing or affected portions, filling in the blanks, so to speak, to rebuild a complete 3D skeletal structure onscreen. During surgery, navigation capabilities and virtual guidance provided by the software allow the fit of implants to be checked in real time, thus surgeons can make changes where needed.

Although virtual 3D models remain useful, working with a physical facsimile of the patient’s ideal skull grants a higher degree of precision to the procedure. Once the skull is printed, surgeons can further test the fit of the titanium implants and adjust them directly along the contours of the mock-up.

The printer completes the NUH’s armament of 3D technologies, allowing each step of the reconstructive process to be fulfilled within the hospital itself. From modelling to printing, these technologies enable surgeons to reconstruct the skeleton with 99% accuracy—even when only half the facial skeleton is left—lowering the margin of error and risk of having to re-operate.

Targeting mainly patients who have severe and complex facial deformities or sustained damage from trauma injuries such as from road accidents, the team has employed the full suite of 3D technology services for 15 cases so far. That number is set to increase as the printing application gets incorporated into routine surgical treatment.

“The skills of even the most capable surgeon can be enhanced with technology to provide better care and outcomes for patients,” says Associate Professor Lim Thiam Chye, Head and Senior Consultant with the Division of Plastic, Reconstructive and Aesthetic Surgery at the NUH. “The ability to embrace such technology comes from collaboration with partners such as the engineering and computer science teams at the NUS.”

The NUH and the Engineering Design and Innovation Centre at the NUS are planning more improvements to the 3D technology platform. A potential upgrade involves integrating 3D motion capture capabilities for convenient and hands-free navigation of software during surgery.

From modelling to printing, these technologies enable surgeons to reconstruct the skeleton with 99% accuracy—even when only half the facial skeleton is left.
New research and services offered by the paediatric and obstetric departments at the NUH offer hope to more families with diverse healthcare needs.

**NEW RESEARCH AND SERVICES**

Offered by the paediatric and obstetric departments at the National University Hospital (NUH) offer hope to more families with diverse healthcare needs.

**FOETAL STEM CELL INFUSION**

A new potential foetal stem cell infusion procedure administered by doctors at the NUH has shown success as a long-term treatment for unborn babies suffering from brittle bone disease. The rare disease is characterised by stunted growth and multiple fractures, and there has been no effective treatment available thus far.

     This stem cell therapy is the first of its kind in Asia. In collaboration with the Karolinska Institutet in Sweden and hospitals in Taiwan, the local paediatric and obstetrics and gynaecology teams infused stem cells into an affected foetus for the growth and improvement of bone tissue. The breakthrough procedure was conducted in 2009, and a follow-up last year showed that the patient has remained healthy.

**FOETAL KIDNEY CLINIC**

In addition, a new foetal kidney clinic was officially set up in June last year to address the increased number of cases with congenital abnormalities of the kidneys or urinary tract. This increase is due to the rise in antenatal screening and more precise imaging technology such as ultrasound.

The clinic helps to prepare and educate parents of affected babies on these conditions and treatments. Also available are counselling and other support services provided by a multidisciplinary team that continues to care for the baby even after delivery.

Most of the babies do not need immediate treatment, but may require follow-ups. With proper and early intervention, these babies go on to have normal kidney function.

**PAEDIATRIC DENTISTRY**

A range of tailored services has also been put in place at the paediatric dental department. The team specialises in caring for the oral health of infants, toddlers, children and young adolescents. However, extending dental care and management to children may sometimes be difficult when they are fearful, or have developmental disorders or oral complications related to the treatment of medical conditions such as childhood cancer. The team is proficient in behavioural management techniques for children and adolescents of varying ages based on their physical, behavioural and cognitive development. This allows the team to better prepare their young patients for dental treatment.

Paediatric dentists on the team also work with other healthcare professionals, such as developmental paediatricians, paediatric cardiologists and the paediatric haematologic/oncology team, to manage the oral care of medically complex children.

**EMMA CARE**

Another tailored service is the Emma Care programme. It is targeted to assist expectant mothers who prefer to undergo natural and unassisted birth. Mothers-to-be will receive primary medical care from NUH obstetricians and support from a team of trained obstetric nurses during their pregnancy, labour and postnatal journey.

A study on Emma Care showed that 75% of the first 100 mothers who used the service were able to have an unassisted birth without the help of Caesarean section or instruments such as forceps, while half of them made it through labour without painkillers. Since its launch in 2011, Emma Care has seen more expectant mothers enrolling for the service.
The Nephrology Evaluation Management and Optimisation programme might be a mouthful, but its acronym more than makes up for it: NEMO. In a way, simplicity is the name of the game for this project, started in 2011 by the National University Hospital (NUH) and the National Healthcare Group Polyclinics (NHGP).

After all, NEMO looks after people suffering from the early stages of Diabetic Kidney Disease (DKD). Where many of these patients have been bombarded with complex health directives, facts, figures and jargon, NEMO hopes to bring results to those in need through its simple and easily understood programme.

REDUCE ESRD & DKD RATES
Singapore is a country that sorely needs programmes such as this. It has the highest incidence of end-stage renal disease (ESRD) due to DKD in the world, and cases of ESRD caused by DKD have almost doubled in the last decade. Kidney disease is the ninth leading cause of death in Singapore. A 2009 study found that, each year, more than 7% of Singaporeans with early stage DKD go on to develop an advanced form of the disease. NEMO patients developed late-stage DKD at about half the rate of patients in the study.

NEMO’s secret is the tight collaboration between primary and tertiary care providers, between NUH nephrologists and NHGP doctors. Polyclinic doctors will identify patients with early stage DKD and put them on appropriate medication. After that, teams from both organisations work together to review guidelines and therapy dosages for these patients.

KEEP IT SIMPLE
NEMO staff help patients manage the process with as much clarity and as little fuss as possible.

- They remind patients to go for regular check-ups, explain clearly adjustments in their medication, and offer advice for healthy diets appropriate for their condition. To ensure that patients’ conditions do not worsen, staff constantly emphasise the need to regularly monitor blood pressure, blood and urine. For example, if the level of the protein albumin spikes in the urine, it can indicate kidney problems due to DKD.
- But NEMO is not only about surveillance. By establishing baselines, it’s more noticeable when things are off-kilter, and doctors can then take steps to reverse irregularities. For
between several specialised care providers, NEMO incorporates an IT system to link them. With the system tracing laboratory results and prescriptions across various polyclinics, each care provider can be on the same page and provide a more holistic treatment. This close monitoring trickles down to the person who matters the most: the patient, whose quality of life is much improved by simplified communication across providers. By stabilising their condition, NEMO also reduces potential medical bills.

Example, 34% of NEMO patients with DKD saw their albuminuria status improve and 24% of them saw their albuminuria levels return to normal after a period of care. Even more impressive, 11% of them had their DKD downgraded from ‘advanced’ to ‘early stage.’ By lessening the severity of the condition, NEMO can add years to the life expectancy of a sufferer.

ONE-STOP SHOP
Because those with DKD may also transfer

TEAMWORK & RELATIONSHIPS
For Professor A Vathsala, Head & Senior Consultant, Division of Nephrology, NUH, and the Programme Director of NEMO, teamwork is just as important as technology. “The encouraging success of the NEMO programme is a result of the commitment of every party involved,” she says. “These efforts highlight the potential for straddling the primary/tertiary care divide so as to provide optimal care for patients with chronic diseases.”

“The programme required tight collaboration between NUH nephrologists and NHGP doctors. Protocols were established and the NHGP doctors optimised drug dosage to achieve target blood pressure and reduce albuminuria to the lowest achievable level while minimising side effects on blood pressure, serum potassium and serum creatinine levels,” adds Dr Loh Ping Tyug, Senior Consultant, Division of Nephrology, NUH, and the Co-director of the NEMO programme.

NEMO doctors also play a crucial role in getting patients to be responsible for their own health, explains Dr Lim Chee Kong, Co-Programme Director of NEMO, who is also Deputy Director of Clinical Services and Family Physician-Consultant of NHGP. The right level of collaboration between caregiver and patient can make all the difference. “Our doctors work with NEMO coordinators to spend time with the patients to understand their lifestyle, advising them to modify areas where necessary so as to empower them to manage their conditions better.”

MINISTERIAL ENDORSEMENT
On World Diabetes Day last year, Mr Gan Kim Yong, the Minister for Health, advised attendees to remain vigilant: “Chronic diseases such as diabetes will become increasingly prevalent as our population ages. The good news is that diabetes is not an inevitable or fatal disease: good nutrition, regular physical activity and maintaining a healthy weight are effective lifestyle interventions that can help reduce the risk. Early detection through screening helps ensure timely treatment and appropriate follow-up. It is important that Singaporeans are aware of the importance of diabetes prevention, and take responsibility for their own health and the health of their loved ones.”
Having provided the doctors with a stool sample, “we blend it, filter out the solid matter and get the microorganisms, which is what we want.”

HEALTH MANAGEMENT

A POOH-FECT CURE

ONE PERSON’S POOP is another man’s cure. It sounds gross, but microorganisms in someone’s waste can be processed and used to treat problem-causing bacteria in your gut.

Taking faecal matter from a healthy person and transplanting it into a patient to cure him of severe diarrhoea sounds decidedly un-medical and counter-intuitive. Yet that is exactly what doctors from the REANIMATE programme ordered for two National University Hospital (NUH) patients earlier this year in what is a first for Singapore and, possibly, Southeast Asia.

GUT CHECK
A healthy gut contains billions of bacteria, says Dr Nicholas Chew, Consultant and Clinical Director at NUH’s Division of Infectious Diseases, and one of the doctors who performed the Faecal Microbiota Transplant (FMT) at the NUH. “What we’re beginning to understand is that they’re all in harmony; there’s a nice ecosystem in there,” he describes. But if you fall ill, your doctor might prescribe antibiotics. These may knock out the infection, but you will be left with a small population of the original bacteria, which are resistant to the antibiotics.

A particularly troublesome bacteria is Clostridium difficile, which secretes toxins as it multiplies. Diarrhoea would be a mild symptom, but “in the severe range, you may experience severe abdominal pain and a risk of perforation of the gut,” Dr Chew warns. “Your bowels might burst and leak, requiring major surgery.”

SCOPING OUT RESULTS
If further antibiotics don’t knock out C difficile, FMT can be the magic bullet to eradicate it. It’s a simple procedure, explains Dr Calvin Koh, another member of the team from the NUH’s division of Gastroenterology & Hepatology.

First, there is a process of donor selection that’s as strict as the process for solid organ transplants. Having provided the doctors with a stool sample, “we blend it, filter out the solid matter and are essentially left with the microorganisms, which is what we want.”

A small number of patients have undergone the painless process via endoscopy or colonoscopy. The results of the 15- to 30-minute procedure have been dramatically positive, with patients seeing a reversal of symptoms within days.

FROM MICRO TO MACRO
There are other plans in the “poopline,” jokes Dr David Ong, Head of the REANIMATE programme. The Consultant and Clinical Director of the NUH’s division of Gastroenterology & Hepatology explains that the team, which comprises two other doctors, Dr Roland Jureen and Dr Reuben Wong, would like to use their experience to explore the use of FMT on everything from inflammatory bowel disease to obesity and diabetes. “There are already studies on mice that show that, if you feed a fat mouse the gut microbiome from a thin mouse, the fat one can become thin!”

HEALTH MANAGEMENT

PooH-Fect cure

(L–R) Dr Calvin Koh, Dr Nicholas Chew and Dr David Ong with the processed stool sample.
Real-time Cancer Diagnoses Now Possible

In Feb 2014, the engineering team from NUS—led by Associate Professor Huang Zhiwei of the Department of Biomedical Engineering, Faculty of Engineering, and Professor Lawrence Ho, the former head of the Department of Medicine at the NUS Yong Loo Lin School of Medicine—revealed to the world the In-Vivo Molecular Diagnostic System, a one-of-a-kind cancer diagnostic tool that detects differences in spectroscopic vibrations in cells to assess their risk of developing into tumours.

Previous diagnostic methods were time-consuming and subjective. In order to detect potentially cancerous cells, the doctors had to rely on endoscopic images. As such, the accuracy of the data becomes subjective and dependent on doctors’ experience, which can lead to different diagnoses. Also, the acquisition and testing of biopsy specimens can be a tedious process, requiring manpower and man-hours.

The In-Vivo Molecular Diagnostic System makes cancer diagnoses faster, simpler and more objective. Based on Raman Spectroscopy, a vibrational spectroscopic technique capable of probing biomolecular changes associated with cellular transformation, it removes the need for unnecessary biopsies. Aside from providing accurate diagnoses in real time during endoscopic examinations, it is even able to detect pre-cancerous tissues almost instantaneously just by touching the head of the endoscopic probe to the target area.

This revolutionary technology was in development in the NUS for a full decade. In that time, the biomedical engineering team worked closely with the clinical team and researchers from the NUS Medicine to gather cancer diagnostic results of more than 500 patients in Singapore across diverse cancer types, such as stomach, oesophagus, colon, rectum, cervix, and head and neck, all in an effort to ‘teach’ the device about the various tumours. Thanks to that database, the device had been achieving 90% specificity and sensitivity by the time it was introduced to the public. The team hopes to make their invention commercially available in the near future.
A $10 million grant from the National Medical Research Council (NMRC) will allow the National University Heart Centre, Singapore (NUHCS), to delve into more extensive research on heart failure (HF) over the next four years. Secured by the NUHCS team, led by Professor Mark Richards, the $10 million, awarded in 2013, will be directed to six major themes of HF research that focus on the mechanisms, markers, and management of the condition.

Under these themes, research work relating to HF cardiac devices, epigenomics and immunology will receive financial backing. It also includes supporting large observational studies in heart failure, heart valve disease and coronary heart disease, as well as clinical trials of new HF treatments. Such research is imperative as HF is the top cause of hospitalisation among the elderly in Singapore and more than half of HF patients die within five years of diagnosis.

**ON TRIAL**

Four therapeutic trials, led by Associate Professor Carolyn Lam, have already been identified for support from the grant. These trials include iron replacement for HF patients with iron deficiency, and continuous positive airways pressure for those with HF and obstructive sleep apnoea. Research collaborations with overseas institutions will also stand to benefit. One such study combines the leading efforts of the National University Hospital (NUH) and data collated from centres in the Netherlands, Australia and New Zealand for an assessment of renal denervation treatment for HF patients with preserved ejection fraction.

**PLANNING AHEAD**

Plans for the third year of funding have already been laid, and they include a multitude of research projects with cutting-edge approaches to HF. In the pipeline is Associate Professor Roger Foo’s novel work on the epigenetics of heart failure, which is one of the six HF themes. Conventionally, a failing heart induces a change in the pattern of gene expression. Taking this requisite change as a starting point, the project aims to identify possible targets in the pathways that regulate the mechanisms of gene transcription. This may pave the way for more effective and targeted HF drug treatments.
Sharing the spotlight alongside drug trials is the research on new technologies, as HF devices are another theme identified for grant support. Miniature cardiac devices, for instance, grant an increased degree of flexibility and mobility to HF patients, while acting as a bridge to a transplant or even serve as a final therapy. Under the leadership of Associate Professor Theodoros Kofidis, a comparative study on new artificial cardiac valve devices will be carried out in pig models of heart failure.

International collaboration is also expected to continue, with plans for a three-centre trial taking precedence. Involving institutions in Singapore, San Diego, and Utrecht, the trial examines the role of therapeutic exosomes as adjunctive therapy for heart attack patients undergoing angioplasty.

The grant may be a boon to the diverse populations of basic, pre-clinical and clinical researchers that make up the project teams; on a larger scale, it also marks the aspirations of the NUHCS. To ensure that the Centre remains competitive and attains higher levels of excellence in the field of cardiovascular medicine—in particular, heart failure—it is hoped that the supported research work will translate into clinical applications in the future.

**ASIA-CENTRIC FACTORS**

An on-going study by NUHCS researchers has already reaped some preliminary data that can be harnessed as clinical application for HF. This new blood test measures the levels of a biomarker called Growth Differentiation Factor 15 (GDF15), which may give doctors further insights into the management of HF cases. An excessively high level of GDF15 is an indication of early heart disease.

Since 2011, the Singapore Heart Failure Outcomes and Phenotypes study has looked at GDF15 levels of 916 HF patients across the country. Researchers found unusually high levels of GDF15 in Asian HF patients and noted that higher levels of the biomarker corresponded with a higher chance of death or re-hospitalisation within a year of the first biomarker measurement.

Current diagnostic processes take into account factors such as age, functional status and a standard biomarker called NT-proBNP.

However, testing of an additional biomarker such as GDF15 will increase the accuracy of diagnosis and identify patients in the high-risk category. This allows doctors to prescribe more specific and effective HF treatments, which may in turn help to decrease the mortality rate of these patients.

Still in its early stages, the study is the first to prove the predictive value of GDF15 among Asian patients and those with diastolic heart failure. It is expected to run for another three years, with an expanded pool of trial participants as well as the inclusion of other factors such as gender and ethnicity.

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**THE A*STAR GRANT OF $10 MILLION WILL GO TOWARDS**

**THREE BROAD AREAS OF HF RESEARCH**
- cardiac devices
- epigenomics
- immunology

**FOUR THERAPEUTIC TRIALS**
- iron replacement for HF patients with iron deficiency
- continuous positive airways pressure for those with HF and obstructive sleep apnoea
- renal denervation in HF with preserved ejection fraction, a collaboration with centres in the Netherlands, Australia and New Zealand
- combined long-acting nitrate plus hydralazine in HF with renal impairment, with later data pooling with larger trials in the USA, Australia and New Zealand

**FUTURE PROJECTS, SUCH AS**
- epigenetics of heart failure by A/Prof Roger Foo
- comparative study on small implantable cardiac assist devices and biological implants by A/Prof Theodoros Kofidis
Sleep Easy

Initiated by the National University Heart Centre, Singapore (NUHCS), researchers from multiple centres have embarked on a large-scale study to investigate the association between obstructive sleep apnoea (OSA) and cardiovascular diseases.

The Sleep and Stent Study focuses on the long-term cardiovascular clinical outcomes of percutaneous coronary intervention (PCI) with stents on patients who suffer from OSA. While preliminary evidence suggests that OSA adversely affects PCI outcomes, these data were largely generated from small-scale, single-centre studies on patients treated with bare metal stents. In contrast, the Sleep and Stent Study, launched in Dec 2011, involves eight centres and 1,850 patients, who were mostly treated with drug-eluting stents. Data collated will be analysed in Aug 2015.

PCI is the standard procedure for patients suffering from symptomatic coronary artery disease, the incidence of which is sharply rising in Asia. More than 300,000 PCI surgeries are performed on the continent each year. OSA is a prevalent but under-diagnosed condition; previous studies in Western countries showed that up to 25% of the general population suffer from it. Researchers from the National University Health System, Jurong General Hospital and the School of Public Health are conducting a study to investigate the prevalence of OSA among the general population in Singapore. The NUHCS has already reported a high incidence of OSA among patients with cardiovascular diseases.

“Elucidating the mechanisms underlying the association between OSA and coronary artery disease is crucial in developing an effective therapy,” says Associate Professor Ronald Lee. He is the Principal Investigator of this study and a Senior Consultant with the Department of Cardiology, NUHCS. OSA, he added, might therefore be a “novel risk factor” and “therapeutic target” in the prevention and treatment of cardiovascular diseases.

House dust mites are the main cause of asthma and allergic rhinitis among Singaporeans, according to scientists and clinicians from A*STAR and the NUS. Almost invisible to the naked eye, these arachnids feed on human detritus and are commonly found in mattresses, pillows and carpets.

Researchers studied around 8,000 people here and found that about 80% of them reacted to exposure to the mites. Asthma symptoms developed in 15% of the subjects while allergic rhinitis symptoms struck nearly 40%. The study also found that those who did not originate from tropical countries were less sensitive to the mites, but the longer they spent in hot and humid climates, the higher their sensitivity.

Given the increasing prevalence of allergy and asthma in Singapore, researchers...
Although discoveries made in the laboratory add to scientific knowledge, their value to medicine is truly realised when they are applied to clinical practice. Translational medicine brings these observations to fruition as treatments or practices. This bench-to-bedside approach to clinical research at the National University Health System (NUHS) received a major boost in the form of an $18 million grant awarded last April.

The four-year grant is funded by the National Medical Research Council. It is directed towards strengthening the research capabilities of the NUHS, which focuses on Metabolic Medicine, Infectious Diseases and Neuroscience Enablers (MINE).

The funding will be used to build core research facilities within the institution. Under neuroscience, the Neuroscience Phenotyping Core performs behavioural studies on neurological diseases and neurodevelopment disorders, including those related to depression and anxiety. The Cognitive Assessment Core provides clinical research capabilities to help studies on dementia and other neurological diseases.

Under metabolic medicine, the Metabolic Phenotyping Core focuses on the conduct of human studies and provides for detailed measurements of insulin sensitivity, insulin secretion and energy expenditure. The In-vitro Experimental Model Core uses human-derived tissues as experimental models for understanding the mechanisms leading to diabetes. The group seeks to use these modalities to identify novel therapies for Type II diabetes mellitus by studying the mechanisms that lead to its development.

Under its infectious disease core, a new BSL3 Core Facility was constructed to support studies on infectious diseases such as avian flu.

SPRINT-TB brings together several inter-institutional research groups. Associate Professor Thomas Dick’s group from the NUS Yang Loo Lin School of Medicine Department of Microbiology will work on identifying novel drug targets in mycobacteria, while Professor Alex Matter’s team from the Experimental Therapeutics Centre in A*STAR will focus on drug discovery, pre-clinical development and animal models of the disease. The programme’s clinical development team, led by Prof Paton, will undertake TB drug clinical trials, including TRUNCATE-TB, a large Phase II / III Asian multi-centre trial for novel drug regimens in patients with drug-sensitive TB. Professor Richard Coker from the NUS Saw Swee Hock School of Public Health will lead treatment delivery research.

SPRINT-TB has also attracted numerous collaborators across NUHS, A*STAR, regional universities and hospitals, as well as academic and industry researchers in Europe and USA. The programme will be overseen by a Programme Steering Committee comprising principal investigators and independent experts.

Given the increasing prevalence of airway allergic diseases in Singapore and Southeast Asia, this study is important in helping us understand why there is such a high number of allergic rhinitis patients in Singapore. Knowing the cause is the first step in developing more effective interventions to improve the quality of life for asthma and allergic rhinitis sufferers,” says Research Associate Professor Wang De Yun, from the department of Otolaryngology at the NUS Yang Loo Lin School of Medicine.
A NEW WAY OF DRUG DELIVERY may help late-stage gastric cancer patients live longer.

Conventional treatments for gastric cancer involve administering drugs orally or into blood vessels. A new method of sending the medicine directly into the patient via his abdominal cavity is being developed in the National Cancer Institute, Singapore (NCIS), and the National University Hospital (NUH). The process is similar to peritoneal dialysis, whereby dialysis fluid is delivered into the abdominal cavity through a tube.

Doctors at the NUH and NCIS are currently testing if this technique can be used in combination with standard chemotherapy to deliver treatment drugs more effectively into the abdominal cavity and help patients with advanced cancer live longer. There is cause for optimism as a similar trial in Japan produced positive results: 80% of patients tested lived for at least one year when the usual prognosis was much poorer.

The NUH and NCIS trial used paclitaxel, a drug commonly used to treat gastric, breast, ovary and lung cancers. It was selected because paclitaxel will stay within the abdominal cavity when it is injected. The implication is that a higher concentration of paclitaxel can be delivered to the tumours within the abdominal cavity with minimal systemic side effects because very little of the drug administered will leak into the blood.

According to the NCIS’ Dr Yong Wei Peng, who is leading the trial, this approach is most likely to benefit late-stage gastric cancer patients with disease predominantly involving the abdominal cavity. The trial plans to recruit 30 patients and is scheduled to complete recruitment in 2015.

The novel technique can minimise treatment side effects by delivering the anti-cancer drug directly into the abdominal cavity.
The NUS has launched three research projects that aim to improve the planning and managing of public health policies and services.

**THE ECONOMICS OF DIABETES**
One of these projects is centred around Type II diabetes mellitus and its growing prevalence in Singapore. In order to forecast the economic repercussions of this chronic disease on the public healthcare system, researchers from the School devised a model framework for calculation. It tracks the occurrence of diabetes in the local population through time, also taking into account other factors such as the changing socio-economic status of the population.

To further estimate the burden of diabetes on society at large, the researchers evaluated various types of costs. Alongside immediate expenses such as medication costs, the model framework considered other major but unseen consequences of diabetes. These include the loss of productivity and rates of premature mortality due to the disease. The Ministry of Health has since adopted the framework for policy and budget planning, the forecast for which was presented at the Regional World Health Summit in 2013.

**SAFE AT WORK**
The second project deals with workplace safety. In collaboration with the Ministry of Manpower (MOM), the public health school conducted a study of 30 workplaces and more than 28,000 workers to identify the challenges and effectiveness in providing integrated and comprehensive Workplace Safety & Health services.

The MOM is currently analysing the results in order to develop new guidelines on these services. Additionally, new tools developed by the School team during the course of the study will be used to introduce these services in the National University Health System and other work sites.

**GENES & PHARMACEUTICALS**
The third initiative is the Singapore Pharmacogenomics Portal (SPP). A collaboration between the School and the Health Sciences Authority, the portal is the first genomics web platform that links population genetics data from the International HapMap Project and the Singapore Genome Variation Project with public resources from PharmGKB and DrugBank.

This platform will help drug regulators and researchers assess how genetic variations across populations affect drug responses, dosages and adverse reactions. The SPP is thus useful when evaluating the possibility of applying trial results to a population that has not undergone direct testing. Given the wide demographics of study groups within the resource’s database, this function may also be applied to populations in neighbouring countries with Chinese, Malay or Indian ancestry.
Researchers are studying the effects of a new form of targeted stem cell therapy on hepatocellular carcinoma, a deadly strain of liver cancer.
An international team of researchers is hoping its latest discovery will lead to better chances of survival for liver cancer patients. It has identified a stem cell gene that strongly indicates hepatocellular carcinoma (HCC), a very common form of liver cancer, leading to more effective treatments for the disease.

In the study—a collaboration between the Cancer Science Institute of Singapore (CSI) at the NUS, the National University Health System (NUHS), the Brigham and Women’s Hospital in Boston, the Queen Mary Hospital in Hong Kong, Queen’s University Belfast, and the Harvard Stem Cell Institute—the scientists found that the SALL4 gene played a crucial role in promoting the development of HCC, and are working on personalised treatments and targeted therapeutics to inhibit its expression.

CANCER LINK TO SALL4 GENE
SALL4 is important for the maintenance and development of embryonic stem cells, but they are typically not found in most adult tissues, explains Professor Daniel Tenen, Director of the CSI. He was thus intrigued when one of his collaborators from Harvard Medical School found a connection between SALL4 and leukemogenesis in 2006.

The professor and his team then hypothesised that the gene must also be associated with solid tumours, and screened a panel of cancers prevalent in Asia for SALL4 expression. They found that SALL4 was most active in HCC. They also studied nearly 400 liver cancer patients from the National University Hospital (NUH) and the Queen Mary Hospital: 10–20% of liver cancer patients expressed high levels of SALL4, while half of the patients expressed moderate to low levels of it. As part of the study, the team used a therapeutic peptide to block the function of SALL4; the process either killed cancer cells or blocked their tumour-forming capability. In animal model experiments, the team noticed that targeting the SALL4 function in cancers led to the shrinking of tumours.

“When a high level of SALL4 is detected in patients with cancers, a more aggressive treatment regimen should be given as it indicates a worse outcome compared to patients with a low level of SALL4,” says Prof Tenen. “As SALL4 has a role in promoting cancer development, blocking its function by drugs is a feasible cancer treatment.”

SUPPRESSING THE SALL4 CANCER CELL
Liver cancer is the fourth most frequently diagnosed cancer in Singapore, but because most cases are only diagnosed at a late stage, survival rates are low. Currently, doctors rely on an array of tests—including ultrasound and computerised tomography—to diagnose the disease. Treatment typically involves surgical resection or combination chemotherapy. But there are major caveats to both procedures.

According to Prof Tenen, surgical resection is only viable for early-stage liver tumours, while chemotherapy has not improved survival rates. Moreover, the only FDA-approved drug for HCC treatment, Sorafenib, only prolongs HCC patient survival by three months, without any improvement to quality of life. “Most HCCs that present at the late stage are not resectable,” Prof Tenen adds. “What urgently needs to be addressed is the development of more effective targeted therapies, and this is where our research comes in.”

The scientists are currently applying their research to develop a drug to inhibit SALL4-expressing HCC cells: a first-in-class SALL4-NuRD inhibitor. Its low toxicity in normal cells also means better quality-of-life outcomes for patients. Additionally, they are developing a non-invasive SALL4 prognostication kit to determine the level of SALL4 in patients. This will aid prognosis prediction for clinicians.

Besides HCC, the team found that SALL4 is expressed in other cancers such as those of the breast, ovary and lung. The drug and the kit Prof Tenen and team are working on will be useful for patients with SALL4-positive cancers—which is about 50% of all cancers, according to the professor.

The team is currently at the hit-to-lead optimisation stage of drug development, and its next step is to perform physicochemical studies on the SALL4-NuRD inhibitor. Clinical trials will follow thereafter, Prof Tenen reveals.

“We not only showed that SALL4 is a useful marker for patient outcome prognostication, but it is also a promising drug target,” he sums up. “HCC is a very difficult-to-treat cancer and, so far, there is no useful targeted therapy for HCC treatment. Identifying a new drug target for HCC treatment is hence very meaningful, and it brings hope to HCC patients.”
FOOD IS MEDICINE

“WE ARE THE PRODUCT OF OUR TIME.”
“We ARE WHAT WE EAT.”

There is more to these familiar truisms than meets the eye, and bold research initiatives involving the National University Health System (NUHS) aims to find firm scientific data on how environmental factors affect early human development and the onset of metabolic diseases such as diabetes.

SINGAPORE CENTRE FOR NUTRITIONAL SCIENCES, METABOLIC DISEASES AND HUMAN DEVELOPMENT (SiNMeD)

On 10 Oct 2013, the NUS, the NUHS and the Singapore Institute for Clinical Sciences (SICS), A*STAR, jointly established SiNMeD with an initial investment of $148 million. SiNMeD builds upon a rich history of collaboration between the NUHS and SICS, with the goal of becoming the leading centre in Asia for research in the nexus between human development, metabolic diseases and nutritional sciences.

The SiNMeD effort is steadily making discoveries that improve the health of Asians, developing talent in this broad field of science and attracting beneficial industrial collaborations.

SiNMeD brings together a multi-disciplinary team of clinicians and scientists to study the developmental determinants of chronic and metabolic diseases in Asians. “Our knowledge of how optimal nutrition and lifestyle can delay or prevent disease onset in Asians is sadly lacking,” says Professor Barry Halliwell, NUS Deputy President (Research and Technology) and Tan Chin Tuan Centennial Professor. “SiNMeD pools the expertise of NUS and A*STAR to greatly improve our knowledge of this area, for the betterment of society.”

CLINICAL NUTRITION RESEARCH CENTRE (CNRC)

The CNRC is one key research centre SiNMeD will be leveraging on to understand the role of nutrition and early development, and the links to the onset and progression of obesity and metabolic diseases.

Officially opened on 28 Jan 2014, the CNRC, the first of its kind in Asia, aims to promote healthier lifestyles by studying the link between food and health. A $20 million joint venture between the NUHS and A*STAR, the CNRC will collaborate with academia and industry to develop a broad knowledge base and solutions that could be adopted by the food industry.

According to Professor Jeyakumar Henry, Director of the CNRC, the Centre will initially focus on using diet for the management and treatment of Type II diabetes and obesity. Prof Jeyakumar and his team will study how food influences glucose uptake and how the structure of food may be manipulated by processing in order to develop foods with health benefits for diabetics and people who are overweight.

GROWING UP IN SINGAPORE TOWARDS HEALTHY OUTCOMES (GUSTO)

To better understand mother and infant nutrition, growth and developmental epigenetics, SiNMeD is building on its collaboration with long-term cohort study programmes such as GUSTO, which, over the past five years, has set up one of the most intensively phenotyped and bio-sampled cohorts in the world, intensively following up on 1,200 expectant Asian mothers and their children.

As the centerpiece of an umbrella study funded since 2008 by the National Research Foundation Translational Clinical Research (TCR) Flagship programme on Developmental Pathways to Metabolic Disease—more familiarly known as Developmental Origins: Singapore (DevOS)—the GUSTO findings reveal that the incidence of gestational diabetes mellitus (GDM) in its Chinese and Indian participants is one in five mothers, far higher than previously thought. One possible measure to combat this is the implementation of universal testing for GDM in expectant Asian mothers. GUSTO researchers also hope to learn the most appropriate criteria and timing to administer the Oral Glucose Tolerance Test in Asians to reduce the burden and adverse outcomes of GDM. Other preliminary findings show that Singaporean women who feel stressed, depressed or anxious during pregnancy may give birth to children who are more easily distracted and have poorer memory. This backs up mounting evidence that the environment in which a baby is conceived, born and grows up in determines the child’s growth and development.

Recognising GUSTO’s significance, Minister for Health Mr Gan Kim Yong announced the renewal of the Translational Clinical Research (TCR) Flagship Programme on Developmental Pathways to Health and Disease: Metabolic, Neurodevelopmental and Related Outcomes at the 8th World Congress on Developmental Origins of Health and Diseases on 19 Nov 2013.

About the journey that has brought local and international researchers to work together in Singapore in this crucial area of research, Associate Professor Chong Yap Seng explains, “The $25 million Metabolic Translational and Clinical Research (TCR) Flagship Programme grant awarded by the National Research Foundation in 2008 brought clinical investigators from NUHS, KKH, SGH and TTSH together with researchers from SICS and other A*STAR research institutes. With our partners from the UK and New Zealand in Epigen, we had the critical mass of talent and resources to compete on the world stage. We have never looked back since.”
IT’S IRON, MAN!

- Heart failure patients with low levels of iron suffer more severe symptoms, a poorer quality of life and worse outcomes—even when the haemoglobin levels are still normal (ie iron deficiency without anaemia)—a sub-study of the Singapore Heart Failure Outcomes and Phenotypes (SHOP) study has revealed. “Studies from other countries have similarly shown that a lack of iron can increase the risk of death or re-hospitalisation in heart failure,” says Associate Professor Carolyn Lam of the National University Heart Centre, Singapore (NUHCS). She is the Principal Investigator of the study. The results of this analysis from the SHOP study could very well change the way people with chronic heart failure are managed and treated. Even now, similar studies in Europe have spurred the European Society of Cardiology to update its guidelines to recommend testing for iron deficiency in all heart failure patients. Locally, the National University Hospital and Tan Tock Seng Hospital collaborated in Aug 2013 to find out if intravenous iron therapy can improve symptoms of heart failure patients with low iron levels. A/Prof Lam and her team look forward to the day when iron testing and appropriate management of patients become standard practice within the local medical community.

A Change of Heart Valve

- A percutaneous mitral valve has been developed by a team led by Dr Jimmy Hon, Consultant Surgeon, Department of Cardiac, Thoracic and Vascular Surgery, National University Heart Centre, Singapore, and Dr Leo Hwa Liang, Assistant Professor, Department of Bioengineering, NUS. The achievement was thanks to funding from the Biomedical Engineering Programme (BEP), administered by the Science and Engineering Institutes of A*STAR.

  Mitral regurgitation (MR) is a serious condition in which the heart’s mitral valve fails to close tightly. This causes a backflow of blood and affects the organ’s efficiency. Because the heart has to pump harder, it could lead to congestive heart failure.

  Currently, the commercially available mitral valve replacement devices require implantation via open-heart surgery. To overcome this limitation, the team has invented a novel bioprosthetic valve that can be delivered through a transcatheter and off-pump approach. This valve would be able to help MR patients who are ineligible for open-heart surgery—the standard treatment for MR—due to other medical issues.

  The device was developed using computer simulation and bench testing. For example, the hemodynamics properties of the valve were assessed in a left heart simulator under physiological flow conditions. A working prototype has already secured intellectual property protection.

  A second Proof-of-Concept grant from the BEP, worth $431,033, will allow the team to further develop the device: the next phase is to implant the valve into live animals to acquire in vivo data on its technical performance.
A CRITICAL LINK EXISTS between paediatric leukaemia and the gene known as microRNA 335 (miR-335). This breakthrough finding by the team at the National University Hospital (NUH) and the National University Cancer Institute, Singapore (NCIS), may increase the rate of survival of young patients suffering from the disease.

Acute lymphoblastic leukaemia (ALL) is the most prevalent form of childhood cancer in the world, including Singapore. While most people with ALL generally respond well to treatments, between 10 and 15% of them relapse. That’s because prednisolone and other drugs related to it—key chemotherapy drugs for ALL patients—tend to fail when it comes to fighting leukaemia cells for this small group of patients.

An extensive study led by Associate Professor Chng Wee Joo and Associate Professor Allen Yeoh discovered that miR-335, a regulatory gene, plays an important role in how patients respond to treatment for ALL. It was found that the patient’s level of miR-335 expression is related to his response to prednisolone treatment and clinical outcome. “miR-335 controls the mitogen-activated protein kinases (MAPK) pathway, which is important for the therapeutic effectiveness of prednisolone. When miR-335 is at a low level, the MAPK pathway is activated. This leads to prednisolone resistance, which explains the poorer clinical outcome,” explains A/Prof Chng.

This discovery is a godsend for ALL patients in many ways. Based on the expression levels of miR-335, doctors can now work out the risk level of a child with leukaemia and his rate of survival as early as the point of diagnosis. This also means that the right amount of treatment can be administered, thus preventing or reducing the severity of side effects. Furthermore, when combined with other diagnostic methods, this genetic indicator enables doctors to better plan treatment strategies for paediatric leukaemia patients.

Cancer drugs based on this study are already being tested in clinical trials that could, in the long run, reverse drug resistance in ALL patients. Additionally, researchers are working to apply this treatment protocol beyond paediatric patients to include adult cancer patients as well. The team behind this study hopes that, in time, the benefits of their research will reach an even wider population, thus providing all leukaemia patients—children and adults—with a higher survival rate and a better quality of life.
SQUEAMISH ABOUT SCREENING

DESPITE KNOWING that early detection of colorectal cancer (CRC)—Singapore’s top cancer—can save lives, many people here avoid getting themselves screened, according to a study conducted by the National University Health System (NUHS).

Doctors and researchers from the National University Hospital (NUH), the NUS Saw Swee Hock School of Public Health and the NUS Yong Loo Lin School of Medicine surveyed 2,000 men and women above 50 years of age. Although all were eligible for CRC screening, the researchers found that psychological, social and financial barriers were preventing three-quarters of respondents from going for regular colonoscopy.

A large majority (83.4%) of the respondents cited high costs as a reason for staying away from such screenings. But researchers insisted that this was a misconception: the procedure costs $250 for subsidised patients and $1,000 for non-subsidised patients, while the Ministry of Health has extended the use of Medisave to include colonoscopy. Then there is the fatalistic attitude shared by respondents. Close to half of them maintain that fate would determine whether they contract the disease—and only about 35% consider themselves to be at risk.

Researchers believe that these findings impede people from taking affirmative action to detect CRC at its early stage. “Clearly, the lack of understanding that they can be susceptible to the disease is worrying,” says Dr Reuben Wong, Assistant Professor and Consultant from NUH’s Division of Gastroenterology and Hepatology, and the Principal Investigator of this study. “The notion of fatalism is also a mentality that needs to be corrected.”

The survey also identified behaviours unique to women. Firstly, women who have family members with CRC were 2.5 times more likely to go for screening. Secondly, Malay females were half as likely as non-Malay women to get themselves screened. Thirdly, more women than men feel the procedure is painful, embarrassing and dangerous.

“The findings are important because they affirm that, instead of a one-size-fits-all strategy, we may have to try a more personalised or gender-specific approach to promote colon cancer screening,” explains Dr Wong.

But the study also noted that physicians can do more. Respondents said that recommendations by their doctors would spur them to undergo screening. Yet, only 22.6% of them said they were currently advised to do so. Dr Wong urges doctors to “create opportunities” for their patients, such as by screening patients in their clinics or smoothening out referral routes to other gastroenterologists or colorectal surgeons.

“Even when the patient comes in for something completely unrelated, it’s important to take the time to explain the screening to them,” he advises.

The findings are important because they affirm that, instead of a one-size-fits-all strategy, we may have to try a more personalised or gender-specific approach to promote colon cancer screening.
Despite rehabilitation being essential for their full recovery, many stroke patients shirk it. But an innovative new tele-rehabilitation system pioneered by the National University Health System (NUHS) hopes to change this by leveraging on motion sensor and video-conferencing technologies.

Currently a randomised controlled trial involving 50 stroke patients, the system allows patients to perform rehabilitative exercises at home as therapists remotely monitor them. Tentatively called Home Rehab, it is designed to overcome the hurdles that prevent patients from attending therapy sessions and, ultimately, help them to attain greater functional recovery.

The two-year study, which has received a $750,000 grant from the Singapore Millennium Foundation, is led by NUS Saw Swee Hock School of Public Health’s Associate Professor Gerald Koh, who is also a family physician. He notes that most of a patient’s motor functions return within the first three to six months after a stroke; this window is a crucial period for rehabilitation. It is worrying that only one-third of patients regularly return for such sessions.

This is due to three main reasons, A/Prof Koh says: physical barriers, such as a lack of personal transport; social barriers, such as not having a caregiver to accompany the patient to rehab; and
Home Rehab is an example of a “novel solution” that effectively addresses an urgent requirement for rehabilitation services among Singapore’s ageing population.

Home Rehab uses Apple iPads, motion sensors and a proprietary app to give stroke patients more convenience, lessen the load on their caregivers and afford therapists greater flexibility. The system is centred on video-conferencing as both the patient and physiotherapist will primarily interact via the tablets.

It works like this: the patient performs prescribed physiotherapy exercises while the iPad records the session and sends the live feed to the therapist’s tablet. Motion sensors attached to the patient’s arm or leg capture data—such as the range of motion of a leg raise—and provide immediate biofeedback to the patient that indicates if exercises are successfully completed. Nonetheless, caregivers will still need to be present to assist the patient.

Videos and data collated will be saved onto a private server for therapists to track a patient’s progress and amend the exercise regimen where necessary. Although the study will include weekly sessions between patient and therapist, Home Rehab also enables the former to carry out unsupervised exercises. Therapists can set targets for the patients and the motion sensors will verify if those targets are met. A/Prof Koh recommends patients to complete these unsupervised exercises once a day, five days a week.

Home Rehab can be done in patients’ homes, thus bypassing the physical and social barriers mentioned. “Each weekly tele-rehabilitation session is estimated to cost $100, but it is much cheaper when compared to a home visit by a therapist, [which] costs between $125 and $200 [per session],” he reveals.

**REFINING REHAB**

Home Rehab is not a “magic pill,” cautions Dr Ng Yee Sien, Head of the Department of Rehabilitation Medicine at the Singapore General Hospital and a co-investigator of this study. The main caveat is that it might curtail patient-therapist rapport. As therapists are used to physically engaging with their patients, they will need time to adapt to this virtual system. “They are starting to see its perks and are working with engineers to refine the design of the system,” reassures Dr Ng.

Dr Ng points out that Home Rehab is unsuitable for patients with complex needs—such as stiffness in muscles and joints—and those who need to work on fine motor movements the sensors cannot track. But he maintains that Home Rehab is an example of a “novel solution” that effectively addresses an urgent requirement for rehabilitation services among Singapore’s ageing population.

Before the trial ends, a team of PhD students and research engineers from NUS ECE plans on setting up a company to develop and market Home Rehab. They have already begun approaching various hospitals in Singapore to gauge their interest, and aim to test-bed the system on a wider scale in 2015.

If the trial is successful, A/Prof Koh and his team hope to extend the use of Home Rehab to amputees and those who suffered injuries—such as a hip fracture—and require intensive rehabilitation.
Make them bleed in training, so that they bleed less in war. This military aphorism rings true at the NUS Yong Loo Lin School of Medicine, where simulation technologies put medical and nursing students through realistic clinical emergencies and situations, and prepares them for the real world.
Three very focused medical students take turns to perform chest compressions on a dying patient. Alarms beep, voices rise and sweat dribbles into their eyes. Through it all, video cameras record the drama. In a darkened adjoining room, an experienced doctor watches the drama unfold through a one-way mirror. He steps out and reviews the recording with the students, who are still flushed from the excitement of their training. It’s just another day at the Centre for Healthcare Simulation (CHS).

Housed in the Centre for Translation Medicine (CeTM) at the NUS Yong Loo Lin School of Medicine, the CHS makes breathtaking use of its 5,247m² of space. There’s an Emergency Room, Paediatrics ward, Labour ward, eight clinical wards, an Intensive Care Unit, Operating Theatre, 60 consultation rooms and more. They are all designed to deliver training to medical and nursing students that’s as close to real life as possible: if students can face what the CHS has to offer, they stand a good chance of dealing competently and confidently with real patients, thus saving real lives.

And, as Associate Professor Suresh Pillai, Director of CHS, gleefully explains, it all starts with patient manikins, fake blood, actors and lashings of fake vomit.

PAINTING A REAL PICTURE

Traumatic injuries can be horrifically messy, so it’s best to prepare students for them early on, so they can work through them. When it comes to bodily fluids encountered by students here, they’re nearly all home-made, says A/Prof Pillai. To create vomit, for example, staff prepare oatmeal and add a special ingredient—chemicals that mimic the sharp, acidic smell of gastric fluid. Other techniques are even less appealing: “We have created blood in the stools by using chocolate pudding, then adding fish sauce.”

It adds up to a pretty chaotic and colourful sensory overload—and so much the better. Such corporeal realism can make all the difference in the training of doctors and nurses, who are able to work past the smells and mess, and concentrate on the medical problem at hand.

Traumatic injuries can be horrifically messy, so it’s best to prepare students for them early on, so they can work through them.
The symptoms of such problems can be faithfully recreated on CHS’s most high-tech tools: a family of lifelike manikins. Under their rubbery skin lie a host of electronics that allow the dummies to cry, speak, bleed and even deliver babies. Meanwhile, wigs, removable limbs and interchangeable body parts make for customisable appearances. Patting a manikin the students have dubbed ‘The Complainer,’ A/Prof Pillai elaborates on what these tools can do: if interns palpate an affected area of the abdomen, for example, the manikins might groan tellingly.

Trainers can choose from pre-recorded sounds or even vocalise through speakers embedded in the manikins. “We can mimic vomiting, coughing, breathlessness, so the students can react to a lot of things,” he reveals. That includes tears, blinking, pupils that react to light, lips that turn blue from deoxygenation or the cold, and even a throbbing pulse.

HAVING FUN SAVES LIVES
It all sounds a mite theatrical in the CHS with such a playful atmosphere—but there’s nothing wrong with that, insists A/Prof Pillai. The ability to learn by playing is one reason why students are responding so positively to the programme.

“They realise it bridges a gap and reinforces a lot of their theoretical concepts,” he says. More importantly, “it’s fun. I think learning must be fun; it’s not all serious. We allow students to laugh and reflect. I think when you give students gadgets and equipment, they take to them like ducks to water, but learn important concepts along the way."

As he explains, this hands-on approach is a move away and up from the usual mode of teaching. Many lectures are online. Still, while it’s practical in terms of infrastructure and time...
saved, students still need human interaction during the learning process. “Simulation allows for interaction both with the faculty and the simulated patient,” he explains. Simulated training also allows students to work together and communicate as a team, as they would in a real clinical setting.

It also handily balances the need for students to approach real patients. At teaching hospitals, patients may not want to be examined several times a day if it’s not necessary, so simulation helps in that area.

**OPERATING THEATRE**

If more face-time is needed, you can always add a Standardised Patient to the mix. These are real people who are trained to mimic certain medical symptoms, which are then presented to students, who must treat them.

As well as helping to hone the students’ diagnostic skills, Standardised Patients also test their interpersonal and communication skills. Role playing helps the students to think on their feet and respond appropriately to unpleasant and unexpected situations. They also learn to break bad news—such as the death of a loved one or an inoperable condition—with tact and empathy.

Sometimes, the planned scenarios throw an even tougher curveball. “We have a hysterical patient who is also suicidal,” describes A/Prof Pillai of one case. “How does the team manage such a patient?” Learning to handle challenging patients while also trying to work effectively as a team helps students to learn and hone essential skills that will prepare them for future careers as healthcare professionals.

“When they are faced with Standardised Patients, they are forced to bring up their own feelings and emotions. They learn a lot about how they themselves are going to handle such situations,” reveals A/Prof Pillai. “In medical school, they are not exposed to these sorts of encounters all the time; it can be quite traumatic for them if they face this for the first time in a real-life setting. So it paves the way; it makes it easier for them when breaking bad news to a relative, or telling someone he has a terminal illness.”

**BE AWARE OF BODY LANGUAGE**

Designing these simulation sessions to a high standard is almost as taxing for the teaching staff as the students. Behind one-way mirrors, A/Prof Pillai and his colleagues sit at an impressive computerised array that controls the manikins in real time. Training the staff to mimic real life is crucial, he insists, “because otherwise it does not become real, and your students can pick that up. The last thing you want is for someone to tell you that this is not what happens in real life.” When watching the students interact with manikins and Standardised Patients, staff also monitor how students react to stressful situations.

That’s where the recording equipment comes in handy. It allows teachers to point out simple facts that were missed as anxious students try to defibrillate a ‘real’ person for the first time. A student might think he is giving clear instructions to team members, but that may not be the case. “They sometimes don’t realise their body language or tone. You know, it’s an unravelling situation, so people raise voices and people get upset. They learn about themselves and how they behave under pressure.”

As someone who has navigated the stressful chaos of an A&E department for years, the professor understands the importance of staying cool and communicating clearly. The advantage of the role play, of course, is that students can learn from their mistakes in a safe environment—there’s no danger of killing a manikin, A/Prof Pillai laughs.

**GOING FAR WITH SIMULATION**

Simulation training forms about 10% of a medical student’s course at the moment, and there are plans for it to form a bigger part of the curriculum, but it will not replace traditional teaching. Rather, simulation training augments what students learn in classroom environments, argues A/Prof Pillai.

Fake blood, lifelike manikins, hospital facilities, stressed-out pretend-patients and all are whirling around students in a carefully orchestrated medical situation. It’s definitely a programme with a steep learning curve, he admits. But many graduated students come back to thank him for the experience. “They say they have just seen their first real cardiac arrest, and they remember the case that we did, and recollect what the steps are.” For him, that’s the true validation of simulation—when it translates into saving actual lives.
Marking another step towards closer collaboration, the NUS and Hebrew University of Jerusalem launched a joint doctoral degree in biomedical science, which commenced in Aug 2013.

The Joint Doctor of Philosophy (PhD) degree programme is a combined endeavour between NUS’ Yong Loo Lin School of Medicine and Faculty of Science and Hebrew University’s Faculties of Medicine and Science. The programme allows students to spend a minimum of nine months at each campus in Singapore and Jerusalem. This enables the students to be exposed to the scientific and cultural advancements of each country, providing a greater breadth of experience and value to their education.

Under the agreement, each institution can enrol two or three students in the programme annually for the next four years, with each university conducting its own selection process. Tuition fees are set in accordance with that of the home institution. Two NUS students have already been selected for the inaugural intake, which was marked by a signing ceremony in July.

This new collaboration also reaffirms the strong ties between the two institutions. Apart from the joint PhD programme, the universities currently offer two student exchange programmes and a joint research venture.

Launched in Jul 2013, the Public Health Thought Leadership Series is aimed at sparking critical conversations and gaining insights on public health issues. Established by the NUS Saw Swee Hock School of Public Health, the series features presentations and discussions with leading experts in the field.

The inaugural series last year was opened by Professor Harvey V Fineberg, President of the Institute of Medicine in the United States of America and former Dean of the Harvard School of Public Health, a position he held for more than a decade. Taking on a pressing concern in modern medicine, Prof Fineberg’s presentation weighed in on the promises of personalised therapies and the implications these treatments have for the healthcare industry and society.

The 2013 series wrapped up with a dialogue session on an important issue: workplace safety and health. Speaking from her extensive experience as the Expert Advisor on Health and Work with the United Kingdom’s Department of Health, Professor Dame Carol Black explained how the integration of workplace health protection and health promotion should be undertaken by businesses for a more productive workforce.

Video recordings of these sessions are available online on the School website.
Information technology has become a key medium of instruction at the NUS Yong Loo Lin School of Medicine. For instance, lecture webcasts are available online for students’ easy access anytime, anywhere. In addition, interactive learning and video conferencing were implemented two years ago for students in the Health Ethics, Law and Professionalism programme. It involves splitting the large student population into small groups, and getting them to interact remotely with each other on group-distinct assignments via video conferencing. The method has been proven to encourage greater engagement between students, and is especially useful when clinical teaching personnel find themselves understaffed.

Other IT developments allow students and teachers to remain connected outside the classroom. These online platforms also make it easier for data to be collected and processed in real time and at a faster rate. Since 2007, an increasing number of assessments are being conducted via an online platform in a supervised environment. Since June last year, student feedback on teachers and courses conducted at the School can be submitted through the Online Feedback System, accessible from any smart device with an Internet browser. Faculty members can access these reports through a new Online Dashboard System. Plans are underway to extend these systems to all teaching sites this year.

When it comes to healthcare, it’s not enough to be highly trained in a specialised field. As Singapore moves towards an integrated healthcare system, healthcare professionals are likely to work increasingly with those of a different specialisation. Understanding the skills and perspectives of fellow healthcare workers with different professional backgrounds is thus essential to working effectively as a team to deliver the most effective, integrated care.

Interprofessional Education (IPE) is a means to achieve this. Incorporated into the medical undergraduate curriculum at the NUS Yong Loo Lin School of Medicine, this holistic form of education allows students from the medical, dental, nursing, pharmacy and social work departments to learn from and with each other. This paves the way for them to be better healthcare workers within interprofessional teams in the future, something known as being ‘collaborative practice-ready.’

Freshmen at the NUS Medicine are required to undertake the Patient-Based Programme as part of the School’s push towards IPE. Students are paired with clinical mentors to learn how to interact with patients as well as to spend time shadowing other healthcare workers, such as psychologists and social workers. This helps them understand the work of their fellow members in a healthcare team, and the importance of a team-based approach to healthcare.

Another example of interprofessional education is the clinical skills foundation course for Phase II students, where some of the essential skills required for patient care are taught to the students by nurses and allied healthcare staff who are the experts in that field.
A WILL FINDS A WAY
Second-year medical student Andrew Arjun Sayampanathan showed what can be done when many hearts, wills and hands come together on a Community Health Integration (CHI) project, which identified a group of senior citizens in Kampong Glam who had gone without dental care for many years. Sayampanathan, who is studying at the NUS Yong Loo Lin School of Medicine, adopted a multi-disciplinary approach and mobilised other medical as well as nursing and dental students to reach out to the old folk at the Pace Connect Senior Activity Centre.

INTER-DISCIPLINARY CO-OPERATION ON THE GROUND
A total of 110 students teamed up to provide free dental screenings and referrals. Relevant equipment, including chairs and lights, were brought down to the screening site, with teachers from the NUS Faculty of Dentistry on hand to help. Aside from the elderly, the dental students also checked on the dental hygiene of young children present.

REACHING THE COMMUNITY
As with all healthcare topics, patient education plays a role along with screening and treatment. The education plan for the residents in Kampong Glam covered primary care diseases, preventative medicine, and the importance of health and dental screening. “We had the idea that the most important thing about primary healthcare prevention—besides

As we focus on patient education, we are forced to spend more time than usual with each resident present and, over time, we will understand better their perceptions and misperceptions regarding diseases and healthcare in general.
screening—is sustained healthcare education in a palatable and easy-to-digest form at a personal level,” says Sayampanathan. “In this setting, we felt that this project would also be an ideal opportunity for future healthcare professionals—such as medical, dental and nursing students—to practise delivering such messages,” he explains. “As we focus on patient education, we are forced to spend more time than usual with each resident present and, over time, we will understand better their perceptions and misperceptions regarding diseases and healthcare in general.”

AN OPPORTUNITY TO WORK TOGETHER
The multi-disciplinary approach also had the added benefit of giving all students a chance to work with each other, as they would as future healthcare professionals in their respective areas. “The designing of a new technique or educational intervention to aid diabetic patients, a new way to health-screen patients, a new way to move the immobile—there are many healthcare and medical problems on the ground that we medical students and the medical community can slowly tackle,” lists Sayampanathan. “It is up to us to identify what these are, feel for them, and do something about them.”
WITH EARLY INTERVENTION, the chances of surviving cancer are much higher. This hopeful fact makes the promotion of cancer awareness and screening all the more important. The National University Hospital (NUH) and National University Cancer Institute, Singapore’s (NCIS) continued partnership with the Singapore Cancer Society (SCS) this year sought to promote this urgent cause.

Previous initiatives under the partnership took the form of public forums during Cancer Awareness months, in particular for colorectal cancer, gastric cancer, ovarian cancer, head and neck cancer, and breast cancer. These forums were conducted in both English and Mandarin and saw attendance ranging between 190 and 450 participants.

The collaboration also saw major campaigns being carried out, notably with the 13th Annual Colorectal Cancer Awareness Campaign in March this year. Although colorectal cancer is the top cancer killer for people over 50 years of age in Singapore, a new approach was employed by the campaign to target a larger demographic: Singaporeans from all walks of life.

By emphasising the importance of early detection and screening, the campaign hoped to inspire them to encourage the people around them to go for screening, especially those above 50 years old. This would essentially be equivalent to getting the message out to an even wider audience, such as their friends, colleagues and family members.

“This year, we hope to reach out to 50,000 individuals through our multi-pronged approach,” says Dr Cheong Wai Kit, Chairman of this year’s campaign. Dr Cheong is also a SCS Public Education Committee Member and a senior consultant in the Surgical Oncology division of the NCIS.

In line with the SCS approach, the NUH and NCIS worked together to rope in private organisations to spread the message to their staff. Health talks were given to staff of eight major organisations—Ethicon, Fujifilm Asia Pacific, Merck, the NUS, PSA Corporation, Shell Eastern Petroleum, SMRT Corporation, ST Engineering—to educate them about colorectal cancer. Faecal Immunochemical Test (FIT) kits were also distributed. This test checks for blood in the stool, a potential sign of cancer that cannot be seen with the naked eye.

The collaborative efforts of the NUH and NCIS were also extended to two primary schools: Fuhua Primary School and Bukit Timah Primary School. Through health talks and educational activities, the campaign sought to have students learn more about the disease and share this knowledge with their families to encourage them to go for screening.

This year, we hope to reach out to 50,000 individuals through our multi-pronged approach.
THE FIGHT AGAINST CANCER is usually a difficult one. Current treatment revolves around three main modalities: surgery, chemotherapy and radiation therapy, explains Associate Professor Jeffrey Low, Head of the Division of Gynaecologic Oncology at the National University Cancer Institute, Singapore.

As most cases involve more than one modality, patients suffer from the cure as much as the disease. “While they are very effective at bringing about remission in patients, they carry their own side effects and long-term impacts,” he reveals.

ReBOOTING tHe LiBiDO
Those side effects can be as emotionally debilitating as they are physically.

Female patients with gynaecological cancers may be saddled with “loss of fertility, loss of sex drive, loss of lubrication in the vagina,” advises A/Prof Low. “The vagina may even be shortened in radical surgery.”

Although effective, radical treatments can’t help but have severe repercussions on the patient’s partner and family; it’s important to realise that these are realities many women face. “After healing them physically, what about the sexual side?” asks A/Prof Low.

AN EMOTIONAL BATTLE
That’s when clinicians such as Dr Cornelia Chee step in.

The Director of the Women’s Emotional Health Services (WEHS) under the Department of Psychological Medicine at the National University Hospital, Dr Chee works with A/Prof Low and the WEHS case managers to ensure that cancer patients’ emotional issues are handled with as much care as their physical ones. Case managers are now a part of the gynaecologic oncology team so that they can answer patients’ questions and help them deal with anxieties that may emerge, even after successful treatment.

Sometimes, the harder we fight, the stronger the cancer bites back. “Treatment with more than one modality is associated with a higher chance of poor psychological adjustment,” explains Dr Chee. Also surprising; sometimes, it’s the younger patients who are less able to adjust. “They’ve got more of life ahead of them, more they have yet to achieve, such as having children,” she reveals. Unfortunately, childbirth may be impossible after treatment.

MORE THAN A CURE
It’s hoped that making available experts in psychology for patients to talk to can ease the emotional trauma that’s likely to crop up. These experts can also bridge communication between patients and their families. The case manager’s presence hopefully “makes it easier for patients and relatives to think about the emotional issues in a way that’s not stigmatising,” adds Dr Chee. The growing number of symposiums here on the subject will hopefully help to achieve this, too.

It’s important to address the person, not just the symptoms, stresses A/Prof Low. Although the health system undertakes a lot of research that translates into good and effective clinical treatment, it’s vital not to underestimate the importance of treating the patient holistically. “It’s about looking after the emotional health, including the adjustment disorders they encounter, and their sexual function. Although cured from the cancer, they need to be able to go back to the person, mother, wife they were before.”

It’s about looking after the emotional health, including the adjustment disorders they encounter, and their sexual function. Although cured from the cancer, they need to be able to go back to the person, mother, wife they were before.
nineteen-year-old Faizal was an upbeat undergraduate who loved nothing more than to spend time at the local skate park. When he fell off a ramp there, he hit his head on a concrete surface. Sustaining traumatic injuries to his brain and spinal cord, Faizal suffered what is known as locked-in syndrome.

Unable to speak or move, Faizal could only communicate by blinking. Who’s going to judge that doctors have really understood the wishes of this boy? And when this boy becomes a man when he turns 21, should his family continue to make all his decisions for him?

Faizal doesn’t really exist. He’s just one of many hypothetical cases, albeit ones drawn from real life, that make up an online Casebook crafted by the Centre for Biomedical Ethics at the NUS Yong Loo Lin School of Medicine. Called Making Difficult Decisions with Patients and Families: A Singapore Casebook, it serves as a space for healthcare professionals to explore ethical issues. These include the financial consequences of treatment, difficulties with home care, confidentiality and much more.

Are ethics taught or caught? The answer could lie within a website full of medical cases that tells stories fraught with ethical issues.

MORAL OF THE STORY

ONLINE TRAINING

When it comes to identifying and then grappling with issues of ethics in medicine, it literally can be a case of the more you learn, the less you know. “Because of that,” says Associate Professor Jacqueline Chin, the Casebook’s editor-in-chief, “we said, ‘Let’s make a website that is available to people easily; they can teach it in clinical settings and they can read it.’” It’s directed particularly at junior clinicians, she explains, because these are the people “who feel the most angst: they have come into medicine, they want to do something for their patients, but they don’t know where to begin.”

Each of the 12 case studies deals with specific types of patients and their problems, and includes commentaries from experienced doctors. But style was just as important as substance, reveals A/Prof Chin. Storytelling was key, with cases presented in short but evocative tales that include dialogue. “It’s narrative that’s structured in such a way that it draws the mind to become puzzled about the problem.”
The technical aspect of our profession is easily learned, but dealing with ethical issues and communicating effectively with patients and families is often more important—and far less easily learned.

Dr Nancy Berlinger, a research scholar at the Hastings Center, was part of the team that helped A/Prof Chin put the Casebook together. For her, it’s all the more useful, considering that it’s a phenomenon that’s growing around the world. “The silver tsunami—the ageing populations in developed nations—means that ethical challenges associated with decisions about treatment and care cannot be viewed as intractable problems, or as ‘family’ issues only,” she explains. “Providing good healthcare in an ageing society means coming to terms, as clinicians and institutions, with the realities of the challenges people are facing during the last decades of life.”

The importance of veracity and context was echoed by the experts who contributed to the casebook. As Dr Berlinger notes, a collateral benefit of putting together the site is that the team was able to identify dozens of local professionals as ethics role models, even if they do not think of themselves as doing bioethics research. The insights they were able to deliver were invaluable. “These professionals were key informants; they helped us to be realistic about how clinicians learn and when they talk to each other about ethical challenges they face,” she reveals. One of the cases had two doctors talking in the parking lot after work—“because a real doctor told us that would be the only time they would have to talk!”

A RESOURCE TOOL
The combination of expertise and attention to detail has paid off: response to the site has been highly positive.

Many junior clinicians have expressed delight at finding a resource online by which they could analyse problems they encountered at work. “The technical aspect of our profession is easily learned, but dealing with ethical issues and communicating effectively with patients and families is often more important—and far less easily learned,” says Dr Lisa Wong, a Resident with the National University Hospital Department of Paediatrics.

The site is meant to be a safe place where healthcare professionals and students can come away feeling engaged, says A/Prof Chin. Because they often don’t have time to seek help in person, “you want something like this, where they can go read it at the point when they need it. And it’s something that will stay with them, like having a personal binder for ethics.”

It’s vital that this ‘binder’ doesn’t grow mouldy with age. Morals have to be exercised, A/Prof Chin insists. “Keep these notes: keep them with you for life. Ethics is an important part of your practice; it’s everything you do and it’s got to be a part of you. You don’t want to lose sight of that.”
The National University Health System Corporate Yearbook

Students also gained access to the new Audiology SMART classroom, the first such facility for an Audiology programme in Southeast Asia.

In Aug 2013, the NUS Yong Loo Lin School of Medicine, with the support of Siemens Medical Instruments, successfully launched the Master of Science in Audiology course.

The establishing of this course could not have come at a more opportune time. According to the National Health Survey in 2010, one in five Singaporeans between 50 and 59 years old and one in four between 60 and 69 years old already suffer from some form of hearing impairment. Aside from losing the sense of hearing, these patients also tend to be less likely to interact with others because of their hearing impairment. Hearing loss is associated with depression, falls, poorer self-care, memory loss and dementia. To address the large demand in hearing care due to Singapore’s fast-ageing population, the number of audiologists here had to be increased, which is why the two-year programme was launched last year with a pioneer batch of 16 students.

Aside from going through a series of specialised audiology modules modelled after the Master of Audiology programme at the University of Melbourne, which has one of the best audiology programmes in the world, students also gained access to the new Audiology SMART classroom, the first such facility for an Audiology programme in Southeast Asia. Within the soundproof room are high-tech video-otoscopy and hearing test stations available for training purposes, as well as a cable network link between the classroom and the Centre for Hearing, Speech and Balance clinic in the NUH Medical Centre, located a stone’s throw away. That way, students are able to receive real-time video and audio feeds from patients and get a more hands-on experience during their training.

Mr Gan Kim Yong, Singapore’s Minister for Health, expressed optimism at the launch of the programme: “This pioneering batch of audiology students will help steer our shared vision to create a new dimension in the Audiology landscape, and create more avenues and access to better hearing health for the population here.” Associate Professor Lynne Lim, the course’s Founding Programme Director, echoed that sentiment: “A larger pool of audiologists would allow us to do more to raise awareness of the importance of hearing well, widen the reach of screening, locate care where it is more appropriate, optimise rehabilitation, expand the range of related clinical services like those for tinnitus and ear-related balance disorders, and do research that brings about meaningful and useful clinical solutions.”
New Admissions Process at Medical School

Medical practice constantly tests the skills and knowledge of healthcare professionals, who will also find themselves struggling with issues involving ethical considerations. New assessment tools adopted by the NUS Yong Loo Lin School of Medicine for its admission process reflect this reality. Implemented in Aug 2013, the overhauled admissions system is in line with the best practices at schools around the world. The traditional admissions process involved an essay test and panel interviews. The new format replaces these components with two new assessment tools known as the Focused Skills Assessment (FSA) and Situational Judgment Test (SJT).

The FSA brings a higher degree of standardisation to the course of selection. Candidates undergo a series of interviews aimed at evaluating attributes such as empathy and resilience. These interviews are conducted at multiple stations, where candidates are given a set of questions or tasks to perform. Trained examiners—doctors, medical alumni or other healthcare workers—ensure standardised assessment at each station. The SJT makes the admissions process more focused. Presented as a multiple-choice questionnaire, it assesses whether candidates can respond effectively to real-life scenarios.

Overall, the new format is more standardised, allows a fairer assessment, and is expected to better predict student performance.

FROM LECTURES TO REAL LIFE

Youth Expedition Projects (YEP), organised by the Alice Lee Centre for Nursing Studies, allow nursing students to apply all that they have learnt in real-world settings. More than that, these expeditions aim to bring out the essential skills and character required of future healthcare professionals.

In 2013, two YEPs—to Indonesia and China—were organised. Leadership and organisational abilities were put to the test right from the beginning as students planned the trips more than a year in advance, dealing with local and foreign partners.

The participants got to apply their school-learnt knowledge to local community needs. In Indonesia’s second largest city, Bandung, they created a mental health awareness programme and helped mental health patients with rehabilitative programmes in a local facility. In China, students in Cangyuan County, Kunming, worked with a local hospital to conduct a pain management programme for farmers. Both nursing as well as medical students grew to appreciate the importance of working in multidisciplinary teams in the long run.

The YEPs this year will visit Bandung and Cangyuan again so that students can continue to nurture the relationships they already have with local hospitals and agencies. However, this year’s participants will be focusing their efforts on the local community in these two cities.

Nursing students teaching the locals first aid.
STORIES FROM THE HEART

The pen can sometimes be sharper than the scalpel. That’s why students from the NUS Yong Loo Lin School of Medicine have gotten themselves involved in the telling of stories that offer hope and courage.

Millennials are often depicted as lazy and self-entitled narcissists, but that stereotype hardly applies to students from the NUS Yong Loo Lin School of Medicine. Where most school-goers would be happy to fling their textbooks and stationery aside when class ends, these medical students are penning stories that they hope will provide inspiration to their peers and patients.

PROJECT F.L.Y
Youngsters might be obsessed with play, but Project F.L.Y is less about the self-gratification of playtime than it is about finding a creative way of helping the community, which, in this case, are those involved in paediatric palliative care.

To that end, Project F.L.Y (Fun-Loving Youths) has produced two books that broach the topic...
There is definitely potential for a rerun, given the treasure trove of amazing stories from amazing doctors, and it’s a great honour for us to pen these stories down so that they can inspire and motivate the next generation.

As medical students have limited interactions with patients and the world of medicine outside of the consultation rooms, wards and classrooms, Project Inspire aims to bridge that gap by collecting the experiences of doctors and putting them into a book. Heartfelt is a collection of short stories based on the lives of 40 doctors and their practices in Singapore.

Put together by the school’s Medical Society in Jul 2013, the book is meant to inspire the students, who can learn from these chronicles of medical journeys before they embark on their own. The content is an amalgamation of contributions from current doctors, ex-doctors and the student pool. Forty students were involved in the work of producing the volume, from writing and dealing with sales to logistics and interviewing medical practitioners. Several of the interviewees are also luminaries in other fields, such as Dr Vivian Balakrishnan, an ophthalmologist who is now the Minister for Environment and Water Resources.

“Initially, the Medical Society wanted to publish a book about the history of medicine in Singapore,” reveals Liang Sai, a fourth-year medical student and the Project Director of Project Inspire. “But I thought that, with so many amazing doctors from the previous generations, we could do more than just recount history. We decided to capture some of these doctors’ experiences to serve as both a celebration of our past and an inspiration for the future.”

The book was also the students’ way of supporting the Christine Chong Hui Xian Bursary. Named after a schoolmate who passed away from lymphoma in 2009, the bursary provides financial help to needy students. Copies of the books were stacked in major bookstores such as Popular, MPH and Kinokuniya. In all, 2,063 copies were sold, raising $43,888 for the bursary.

When asked if the Medical Society would compile a sequel to Heartfelt, Liang would only say, “There is definitely potential for a rerun, given the treasure trove of amazing stories from amazing doctors, and it’s a great honour for us to pen these stories down so that they can inspire and motivate the next generation.”
The loss of one’s teeth, whether through accident or ageing, can be so traumatic that it negatively affects one’s outlook on life. That is because simple actions such as eating or smiling become a source of much stress and embarrassment.

Even more troubling is the fact that damaged dental hard tissues do not regenerate—they can only be surgically replaced or reconstructed. This is why prosthodontics, which focuses on dental prostheses, is such an essential branch of dentistry.

Traditionally, prosthodontics is taught through a ‘watch-and-learn’ format: a tutor performs a live demonstration on a simulator manikin in front of a group of dentistry students. When the classroom size is small, this method works fine. However, when there is a large number of students, those further away from the tutor will have trouble seeing the tutor in action.

To address this deficiency, the Faculty of Dentistry at the NUS decided to integrate video and mobile technologies into its pre-clinical prosthodontic classes, allowing students to learn at their own pace and time. This is crucial when it comes to prosthodontics training because, while interactive and collaborative portions of the course exist, it is a time-sapping discipline that demands fine psychomotor skills and repetitive manual dexterity. As such, having online video instructions that are accessible around the clock allows students to learn at their own time. The payoff? Learner-centred, self-guided education, where students go on to subsequent stages at a pace at which they are comfortable.

Using online tools is nothing new for the Faculty of Dentistry. After all, almost every faculty in NUS, including the Faculty of Dentistry, uses the online platform for various purposes, including teacher-student communication and even online tests. However, these pre-clinical videos mark the first time that such technologies are being used as an integral part of training.

The teaching staff have made videos of various prosthodontic procedures performed on simulator manikins and uploaded them onto NUS servers. This allows simultaneous viewing by all students during after-class reviews or when they are practising on their personal simulator manikins. And since these videos are optimised for mobile platforms as well, students will be able to view them anytime, anywhere.

Videos of surgical procedures are not
the only ones available. Students can also access videos that touch on other topics, such as patient management and clinical behaviour. All this adds up to several hours of step-by-step instructions that are available on demand.

By making these video tutorials readily available to students at all times, the Faculty of Dentistry has effectively created a conducive and future-ready learning environment for its students to perfect their craft.

“We constantly look for ways to leverage appropriate educational technologies to innovate our teaching and engage the younger generation of students. Through this online and on-demand platform, we foster the value of independent learning among them. This is a core competency that 21st century dental surgeons should acquire to empower them to deliver the best evidence-based care for their patients,” says Associate Professor Grace Ong, Dean, Faculty of Dentistry.

**FACETS OF DENTISTRY**

**Other than prosthodontics**, which deals with dental prostheses, there are several other disciplines of dentistry that you may not be familiar with:

**Endodontics:** Endodontists specialise in what is inside your teeth; as the name suggests, ‘endo,’ derived from the Greek word ‘endon,’ means ‘within.’ An endodontist is interested in your dental pulp, the tissue and cells in the centre of a tooth; they are the experts you should consult for root canal therapy and dental trauma, such as cracked teeth.

**Periodontology:** Periodontology is the specialty that studies the supporting structures of teeth as well as diseases and conditions that affect them. The supporting structures include the gingiva (gum), alveolar bone, cementum and the periodontal ligament.

**Orthodontics:** An orthodontist is concerned with the study and treatment of malocclusions, or improper bites, and is most commonly associated with the installation of dental braces.

**Oral & Maxillofacial Surgery:** Specialists in this field manage and treat oral diseases, injuries and defects in the head, neck, face, jaws as well as the hard and soft tissues in the mouth with a range of surgical and non-surgical treatment modalities.

**Paediatric Dentistry:** Paediatric dentists specialise in the treatment and management of oral conditions in children and adolescents. They also monitor the craniofacial and dental growth and development in the young.

**Geriatric Dentistry:** Ageing is often associated with a slew of changes to the oral cavity. Geriatric dentists receive special training to manage a wide range of oral conditions in the ageing population, including those with complex medical conditions. They address the restorative, prosthetic and rehabilitative oral health needs of the older population.

**Oral Medicine:** This discipline is concerned with the diagnosis and management of medical conditions that affect the mouth and its surrounding structures. It also plays a pivotal role in the oral healthcare management of medically compromised patients.

**Dental Public Health:** This discipline is concerned with the epidemiology of oral diseases. It addresses the prevention and control of oral conditions as well as the promotion of oral health among populations and individuals.
Training medical residents is not only about imparting clinical knowledge; it is about encouraging concern for others and stoking curiosity about medical mysteries.
The interconnectedness of the world in which we live means that it takes mere days for a disease outbreak in one locality to morph into a global pandemic. The SARS crisis is a stark illustration of the risk and reality, as are outbreaks such as MERS and Ebola.

It is against this contemporaneous background that the NUS Saw Swee Hock School of Public Health launched a Minor in Public Health this academic year.

The modules within the Minor will help students to develop the knowledge, skills and approaches needed to understand and help address today’s public health challenges in Singapore, Asia and the world.

The Minor is designed to help students improve the health of individuals and entire communities. It also prepares students for careers in public health. The curriculum combines and complements a wide variety of disciplines, involving fields from accountancy to engineering, anthropology to computer science, medicine to policy-making, and many more.

An efficient and effective public health system is essential to a country’s economic and social development. As Myanmar’s economy continues to develop and its public institutions evolve, trained public health specialists and leaders are increasingly in demand.

To help meet the need for public health expertise, the NUS Saw Swee Hock School of Public Health has partnered the University of Public Health (UPH) in Yangon, Myanmar, to help build capabilities in public health.

The programme is aimed at training professionals in the area of public health policy as well as in specialist technical capabilities. Courses to update trainee specialists on the recent medical advancements in specific fields such as occupational medicine are offered. Participants from Myanmar, both from within and outside UPH, are given training in different fields and in a variety of institutional settings in the health sector.

Furthermore, a select group of participants will visit Singapore to receive advanced practical training in the area of public health. Upon completion of their training, these participants will return to Myanmar to share their experience and insights gained with the others in the programme. The cascading of knowledge will increase the capacity of highly trained professionals in the field of public health.

This joint initiative is funded under the Temasek Foundation’s mission to support capacity-building programmes that can make a meaningful impact on communities in Asia. The hope is that regional collaborations such as these can pave the way to a healthier world.
BEYOND THE CONSULTATION ROOM

The community projects initiated by students from the NUS Yong Loo Lin School of Medicine inspire confidence that the next generation of medical healthcare workers have their collective heart in the right place.

CONSTRUCTING CARE COLLABORATION

Looking into a patient’s illness isn’t quite the same as looking at the patient in the treatment room. The trained eye of a medical professional may be able to identify clues for a possible diagnosis, but there may be other problems that plague the patient as well. The Constructing Care Collaboration (CCC) project brings medical students up close and personal with the people they are learning to look after.

Singapore owes its famed infrastructure and services to an army of foreign workers, yet these people lack affordable facilities catering to their healthcare needs. Three students from the School—Andrew Sayampanathan, Daniel Lim and Joshua Tan—felt it was important for medical students to understand these guest workers in order to better serve this community, and kicked off the CCC project in 2013.

CCC is a programme that allows medical students to be involved with Singapore’s transient overseas communities, such as foreign migrant groups. It has two aspects: social awareness and social action.

Last year, 50 students volunteered to assist doctors at a community clinic once a month over a period of six months. Students were tasked with preliminary history taking, physical examination and health education of the patients, who were mostly migrant workers. But the more important part of their work was talking with these patients in order to gain insights into their lives—something textbooks could never provide. This gave the students greater empathy for the migrant workers’ situation while presenting opportunities for meaningful connections—even friendships.

“I got involved after having gone to India four times to teach first aid in a rural village, during which I realised the need to reach out to such people, and that migrant workers in Singapore are most probably as poor as the people there. In a way, serving migrant workers here is the same as serving the underprivileged overseas, except you can do it in your own backyard and hence, on a more regular basis,” reveals Sayampanathan.

After engaging with the migrant community, the students conducted public seminars for members of the public so that they can understand the difficulties these workers face. Plans are also underway to involve the Ministry of Manpower in future seminars under the CCC initiative. Both the student population and the public have responded to the CCC project positively. The project is carried out twice in one academic year, each lasting up to seven months. While each cycle has a fresh batch of student volunteers, about 20% of former volunteers join the second cycle—but they must take leadership or teaching positions. “We believe that the experience is increased when an individual teaches and leads, but no issues if they want to interact with migrant workers on top of their roles. The key is to encourage them to participate in other ways so that they can grow towards community activism and leadership,” Sayampanathan explains.

In a way, serving migrant workers here is the same as serving the underprivileged overseas, except you can do it in your own backyard and hence, on a more regular basis.

Medical students exploring a migrant worker’s medical problems at a community clinic.
Another project is also making a positive impact, this time beyond the campus and the country. Children of Cambodia is a project started and run by NUS Medicine students aged 26 years and under. In Sep 2013, it made history by establishing Cambodia’s first neonatal ward. That project addressed a critical issue: Cambodia’s high infant mortality rate. Specialised neonatology care is imperative in a healthcare system, but the practice and infrastructure were lacking there. The dedicated neonatal ward built by the project at the Angkor Hospital for Children (AHC) in Siem Reap is meant for infants 28 days and younger.

Besides raising funds for the ward, the project also trained Cambodia’s first dedicated team of neonatologists, with help from the National University Hospital’s Department of Neonatology, the Department of Reconstructive and Aesthetic Surgery at Singapore General Hospital (SGH), as well as doctors from both public and private sectors.

For an even deeper impact, the local medical community was taught essential skills in the delivery of good healthcare. Local stakeholders were also consulted on on-ground needs, and experts from various sectors in Singapore were engaged to come up with a programme to meet those needs. “Our ultimate goal is to allow them (Angkor Hospital for Children) to be self-sufficient. We provide the basic structure and know-how, then work towards handing it over to doctors there,” says Dr Jonathan Ng, Chairman of Children of Cambodia.

The international community has been supportive. The neonatal project’s current partners are the University of Oxford in the UK, and Thailand’s Mahidol University. Furthermore, the project has been inundated with requests by American institutions for collaborations, and by Norwegian journals to publish articles.

The students are already working hard on their next target: a burns and reconstructive unit, to be constructed with the help of surgeons from SGH, AHC and Harvard University in the USA. Certified burn centres and intensive-level burn care are currently absent in Cambodia.

Besides benefiting Cambodia, Children of Cambodia mentors other groups in the NUS Medicine that are involved in overseas community development. It hopes to help these groups fulfil their aims by tapping on its experience in providing rural medicine and developing programmes in resource-poor environments. “We aim to provide an avenue for people to use their skills in an appropriate manner. Everyone has their skills, be it in marketing or design, and we aim to harness that,” Dr Ng shares.
MILESTONES

What our outstanding staff have achieved in the past 12 months.

- “For his outstanding contributions to development of the research landscape in Singapore and his excellent research on the role of free radicals and antioxidants in human health, nutrition and disease,” Professor Barry Halliwell, the Tan Chin Tuan Centennial Professor from the Department of Biochemistry, NUS Yong Loo Lin School of Medicine, was awarded the President’s Science and Technology Medal 2013 by President Tony Tan Keng Yam.

- The International Association of Dental Researcher–Southeast Asia (IADR-SEA) Distinguished Service Award 2013 was handed to Associate Professor Keson Tan from the NUS Faculty of Dentistry in appreciation of his outstanding service and dedication to the IADR-SEA Division. The award was presented at the second meeting of IADR–Asia Pacific Region, which took place from 21–23 Aug 2013 in Bangkok, Thailand.

- Ms Chia Lay Hoon, Deputy Director of Nursing, NUH, received the President’s Award for Nurses from President Tony Tan Keng Yam on 31 Jul 2013 at the Istana. For his outstanding contributions to development of the research landscape in Singapore and his excellent research on the role of free radicals and antioxidants in human health, nutrition and disease,” Professor Barry Halliwell, the Tan Chin Tuan Centennial Professor from the Department of Biochemistry, NUS Yong Loo Lin School of Medicine, was awarded the President’s Science and Technology Medal 2013 by President Tony Tan Keng Yam.

- At the 2013 NTUC May Day Model Partnership Awards, the NUH was conferred the Plaque of Commendation (Gold) on 28 Apr for its consistent and significant contributions toward good labour-management relations, workers’ welfare and NTUC initiatives. The May Day Model Partnership Award 2013 (Individual Category) was awarded to Ms Hasnah Bte Mahdi, Coordinator, University Digestive Centre, on 18 May.

- NUH is the first hospital in Singapore to be certified by the Baby Friendly Hospital Initiative (BFHI) when it was accredited on 1 Aug 2013. The initiative, first developed by the World Health Organization and United Nations Children’s Fund in 1991, prepares hospitals worldwide to create an environment conducive for mothers to breastfeed exclusively after childbirth. Since BFHI guidelines were implemented, exclusive breastfeeding rates at NUH have hovered around 75–85% compared to the national average of 50.3% in the 2011 National Breastfeeding Survey by the Health Promotion Board.
Together with MOH Holdings, NUS hosted the first World Health Summit, Regional Meeting–Asia (WHSRMA) from 8–10 Apr 2013. This meeting is an offshoot of the World Health Summit, an annual event held in Berlin, Germany, considered the healthcare equivalent of the World Economic Forum. With Asia leading the world in economic growth, the WHSRMA was organised to address the region’s specific needs when it came to healthcare and health systems.

May 2013, the NUH was the first local hospital to achieve new JCI Academic Medical Centre standard.

At the 2013 Singapore HR Awards, which lauds organisations and HR practitioners who have demonstrated how critical HR is to businesses and staff development, the NUH was one of the winners in the ‘Leading Practices in Employee Relations & People Management’ category.

Other recognition that the NUH received last year include:
- 2013 SHARE Gold Award
- Total Defence Awards (Employers) 2nd Tier: Distinguished Defence Partner Award

The Department of Surgery, NUS Yong Loo Lin School of Medicine, celebrated its centenary in 2013. Associate professors Philip Iau and Mikael Hartman embarked on a motorcycle journey across 17 countries, covering more than 23,000km from Singapore to Sweden in Mar 2014 to raise awareness and funds for breast cancer research in Asia and to create collaboration.

NATIONAL DAY AWARDS 2013

- Public Administration Medal (Bronze):
  Prof Bay Boon Huat
  Adjunct A/Prof Lee Siu Yin

- Public Service Medal (PBM):
  Maj (Ret) Maser Bin Mansor

- Commendation Medal
  Chan Seiw Looi
  Karen Koh Wei Ling
  Pang Wei Shen
  Poh Lay Lay

- Efficiency Medal:
  Chua Ming Siek
  Lee Teck Ngee
  Lim Li Ping
  Mariam Bee Bte Mahmood
  Christina Ng Kew Tiang
  Salinah Bte Abdullah
  Seet Kim Neo
  Sharifah Bte Mohd Deh
  Catherine Teo Pai Pai
HEALTHCARE HUMANITY AWARDS 2013

This is given to inspirational healthcare workers who have displayed high levels of courage, dedication, selflessness, ethics, compassion and humanity. Among the winners were these six from the NUH:

- Cindy Chua Hsu Fung
- Dr David Terrence Consigliere
- Kek Lay Kee
- Lee Soo Chin
- Margaret Tan Lay Hong
- Yong King Chui

NATIONAL MEDICAL EXCELLENCE AWARDS (NMEA)

The annual National Medical Excellence Awards (NMEA) recognises healthcare professionals who have demonstrated excellence in the fields of research, knowledge translation, clinical practice and healthcare delivery.

At the sixth awards presentation ceremony, which was held on 24 Jul 2013 at the Goodwood Park Hotel, five of the six categories went to NUHS staff. They were:

- **National Outstanding Clinician Scientist Award:**
  A/Prof Yeoh Khay Guan

- **National Outstanding Clinician Mentor Award:**
  A/Prof Quah Thuan Chong

- **National Outstanding Clinician Educator Award:**
  A/Prof Shirley Ooi

- **National Outstanding Clinical Quality Activist Award:**
  A/Prof Quek Swee Chye

- **National Clinical Excellence Team Award:**
  A/Prof Dale Fisher (team leader), A/Prof Raymond Lin, Cathrine Teo, Lisa Ang

Established in 1994, the National Medical Research Council (NMRC) oversees the development and advancement of translational and clinical research in Singapore. It promotes, coordinates and funds translational and clinical research here. Since its inception, NMRC has supported more than 200 clinicians. This year, the awards were handed out from 26–27 Feb at the Grand Copthorne Waterfront Hotel. The following were recipients from the NUHS:

- **Singapore Translational Research (STaR) Investigator Award:**
  - Prof Wang Tien Yin
  - Prof Daniel G Tenen
  - Prof Toshio Suda

- **Clinician Scientist Award–Senior Investigator:**
  - A/Prof Roger Foo
  - A/Prof Koh Woan Puay
  - A/Prof Carolyn Lam
  - Prof Nicholas Paton
  - Prof Nobuhiro Yuki
  - A/Prof Allen Yeah

- **Clinician Scientist Award–Investigator:**
  - A/Prof Koji Kano
  - A/Prof Ng Kar Hui
  - A/Prof George Yip

- **Transition Award:**
  - Dr Kao Shih Ling
  - A/Prof Ronald Lee Chi-Hang
  - A/Prof Ng Siak Bien
  - Dr David Tan Shao Peng
  - Dr Jimmy Teo Boon Wee
  - Dr Kavita Venkataraman
  - Dr Makoto Yawata
Here is a comparison chart of some facts and figures for 2012 and 2013.

### Average Length of Stay

<table>
<thead>
<tr>
<th></th>
<th>FY2012</th>
<th>FY2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>5.9</td>
<td>6.0</td>
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</tbody>
</table>

### Number of Patient Days

<table>
<thead>
<tr>
<th></th>
<th>FY2012</th>
<th>FY2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>340,069</td>
<td>355,808</td>
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</table>

### Specialist Outpatient Clinic Patients

<table>
<thead>
<tr>
<th></th>
<th>FY2012</th>
<th>FY2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>704,568</td>
<td>729,134</td>
</tr>
<tr>
<td>Private</td>
<td>265,626</td>
<td>268,356</td>
</tr>
<tr>
<td>Subsidised</td>
<td>438,942</td>
<td>460,778</td>
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</table>

### Emergency Attendances

<table>
<thead>
<tr>
<th></th>
<th>FY2012</th>
<th>FY2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>149,559</td>
<td>159,735</td>
</tr>
<tr>
<td>Children’s</td>
<td>24,780</td>
<td>26,600</td>
</tr>
<tr>
<td>Emergency</td>
<td>124,779</td>
<td>133,135</td>
</tr>
</tbody>
</table>

### Surgical Procedure

<table>
<thead>
<tr>
<th></th>
<th>FY2012</th>
<th>FY2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>59,969</td>
<td>68,174</td>
</tr>
<tr>
<td>Inpatient</td>
<td>26,818</td>
<td>30,420</td>
</tr>
<tr>
<td>Day Surgery</td>
<td>33,151</td>
<td>37,754</td>
</tr>
</tbody>
</table>

Receiving unpleasant news about your health is always difficult. Mr Moni Kishor Chandra Das, then 38, thought he was going to die when he was told that he had leukaemia. Aside from dealing with the emotional distress, Mr Moni was also concerned about his hospital bills. Married with no children and the sole breadwinner of the family and earning a meager salary as a ship electrician, he knew could not afford the hefty bills incurred from cancer treatments. He was, however, introduced to the NCIS Fund through a medical social worker at NUH, which enabled timely treatments for Mr Moni and paid for his hospital bills. Mr Moni is currently in remission and is grateful for the financial assistance he received.

The NCIS Fund is one of the key funds under the NUHS that helps needy patients like Mr Moni to meet their healthcare needs. In 2013, the NUHS disbursed a total of $1,371,000 to 478 patients.

The NUHS also offers bursaries to alleviate the strain on medical, nursing and dental students who come from lower-income families and face difficulty in paying for their course of education. In 2013, the bursaries under the Fund have helped reduce the burden of 171 students who received a total of $1,617,115 in funding.

The NUHS also has a medical research arm which funds research projects aimed at finding better ways to diagnose, treat and manage medical conditions. In 2013, the fund helped 10 projects pursue their research in key healthcare areas that have enhanced the lives of our patients.