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Innovating for future health

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It is a great honour to be given this opportunity to be the Singapore Medical Association (SMA) Lecturer this year. When I started thinking about the lecture topic, I did some research on SMA. One of the documents I came across was an SMA 40th anniversary publication in the April 1999 edition of the *Singapore Medical Journal* (*SMJ*), and one of the articles, '*Conversation with Past Presidents*', caught my eye. In the article, SMA's past presidents were recalling SMA's relationship with the Ministry of Health (MOH), Singapore, and the government. Dr Choo Jim Eng recalled that "*it was the experience then [1970s] that the Guest of Honour at SMA functions would give the profession a pasting*", while Dr NK Yong said that, in the '80s, "*SMA functions were looked upon by MOH with some suspicion*".[1]

However, when I was with MOH from 2000 to 2004, I felt that we had a fantastic working relationship with SMA. SMA was instrumental in helping the Ministry drive and lead many new programmes, including the new Specialist Accreditation Board framework, the Continuing Medical Education (CME) framework and the combat against the severe acute respiratory syndrome epidemic.

SMA has been an effective and important voice for medicine in Singapore. Perhaps the best way to capture this is by looking at what the *SMJ* has been covering. In the SMA 40th anniversary publication, Prof Kua Ee Heok reflected, "*… in the last four decades, the SMJ has chartered medical progress and reflected the socio-economic transformation of Singapore*". The first issue of the *SMJ* in June 1960 looked like a tropical medicine type of journal, focusing on tetanus, maternal mortality, whipworm infestation and intestinal parasites. By 1998, the journal was covering topics like liver transplantation, mental health, peripheral blood stem cell transplantation and why patients complain.[2]

MAJOR HEALTH CHALLENGES TODAY

Moving forward, the health challenges of Singapore have changed over time. We are facing an epidemic of chronic, non-communicable diseases.[3] Today, we do not look at mortality alone, but also years of life lost to premature mortality and years of healthy life lost to disability. If we take this measure – disability-adjusted life years – five broad causes account for 70% of the burden of disease: cardiovascular disease (20%); cancer (19%); neurological, vision and hearing disorders (14%); diabetes mellitus (10%); and mental disorders (7%)[4] – all of them chronic diseases. As we all know, Singapore has a rapidly ageing population. When I visited my aunt at Khoo Teck Puat Hospital (KTPH) recently, I thought the general ward was a geriatric ward because it was full of elderly people who appeared to be above 80 years old.

Based on the United Nations Population Division – Profiles of Ageing 2013, the rate of increase in Singapore's ageing population is much steeper than that in the United States (US), the United Kingdom, and even China. As people age, the burden of chronic disease rises sharply – not linearly but exponentially.[5]

In practical terms, this means that by 2030, there will be three times more elderly people above 65 years old. On average, each person above 65 is four times more likely to be hospitalised. If they are hospitalised, they are likely to stay longer. The annual expenditure on hospitalisation for someone over 65 years old is three times more than that for someone who is 45.[6-9] So the impact of ageing, which we are already feeling, is extremely significant and will have a massive impact on our entire healthcare system in a very short span of time. Although we often hear this, I think we also consistently underestimate the impact of ageing.

Another issue is the rising healthcare costs. There are various ways to look at this, but if we look at the government's direct spending on healthcare, it has doubled from four billion in 2011 to eight billion in 2014. Part of this is because the government is taking a larger share of the overall healthcare expenditure. The other part is because of rising healthcare costs. Here is a funny quotation from an SMA newsletter in 1994:

Doc: Judging from your complaint, it appears your sickness is hereditary.

Patient: Thank you, doc. In that case, send the bill to my grandfather.

This joke is of a rather distinguished pedigree, because it originated from our former president, Mr Wee Kim Wee, on the occasion of his conferment of the SMA Honorary Membership. Although it is unlikely for our medical bills to be passed on to our grandfathers, it is quite easy for us to send the bills on to our grandchildren. So, as we wrestle with the different challenges of the healthcare system, it is important to constantly bear in mind that we have to act today so that we do not end up sending the entire bill, or most of it, to our grandchildren.

Another challenge is the stagnant or falling healthcare productivity in our health systems. In Singapore, it is very hard to determine this because our health system is in a phase of rapid expansion and capacity-building. An article published in the *New England Journal of Medicine* in 2011 noted that healthcare in the US, as it is currently designed and delivered, is very labour-intensive; in 2010, healthcare employees accounted for nearly 12% of the entire labour force.[10] Almost 12% of the entire labour force was in healthcare, but unlike virtually all other sectors of the US economy, healthcare experienced low gains over the past two decades in labour productivity. A chart from the same paper showed productivity and employment growth in different sectors of the US economy between 1990 and 2010. For healthcare, although both the sector and employment grew, it was the only sector that registered a negative productivity growth of –0.6%.[10] Well, this is changing with the different dynamics in the US, and labour productivity is also slowly creeping up in the OECD

(Organisation for Economic Co-operation and Development). But if we continue with the current models of care delivery, even if we have sufficient money, there simply will not be enough trained personnel to meet the rising demand. This is because many developed countries today meet the gap by importing trained healthcare workers from other countries. However, as emerging countries start to become more affluent, they too will have the capacity to absorb more of the trained manpower. Where will that trained manpower come from in the future then?

HOW SHOULD WE RESPOND?

These are the healthcare challenges that we face today. How should we respond? Are our health systems today optimally structured for this rapidly changing health landscape? I think the answer is 'no', as most healthcare systems – including ours – are not really structured for this change. This is because our health systems are still largely centred on hospitals. If you look at a continuum of human health – from normal to advanced disease – most of our focus is on disease and advanced disease, individual patients and acute hospital-based medicines. This was completely understandable and appropriate until more recent times when health patterns started to change. This approach was also completely reasonable then because the populations were younger, cures were being found for diseases, and much more was being done for the individual that could not previously be done. However, we now face a situation where we have massive increases in chronic diseases – many of which are non-complex – on top of a stable burden of infectious diseases. If the burden of all these chronic diseases falls largely on acute hospital-based medicine, then we have a fundamental mismatch.

We have a fundamental mismatch in two ways. The first is the capacity of the hospital system to cope and the second is a philosophical one. Many of us who are from acute hospital systems are trained to deal with high-complexity and high-intervention situations, and we are often high-tech and, therefore, high-cost. This is appropriate if the condition requires this type of treatment, but if non-complex patients start seeking treatment in a setting that has instincts for high-complexity and high-intervention treatments, it will cause another set of fundamental mismatches.

So, what can we do to restructure? I'm sure that everyone in this audience knows that expansion into primary care medicine is critical, and thus a foregrounding of public health and an emphasis on population health is required. If you are able to distribute the interventions that we bring, to mitigate the impact of these massive increases in chronic diseases, then we have a better chance of ameliorating the longer-term impact. This is not new, because MOH, Singapore, has been tackling this problem – as seen in its speeches and documents – over the last two to three decades. Many other institutions have also commented on this. One example is a white paper by the American College of Physicians published in 2008,[11] which consists of a literature review of the value of care provided by primary care physicians. The evidence suggested that primary care physicians deliver care similar in quality to that of specialists for certain conditions such as diabetes mellitus and hypertension while often using fewer resources, as well as providing better preventive care than specialists. It was also found that preventive care provided by primary care physicians can help to reduce hospitalisation rates.[10]

I think many of us concur with the above statement. The question is, "How do we go about extending it?" Even if we are able to deal with the massive increases in chronic diseases, the large number of elderly people coming in with multiple medical problems will demand even more. It is true that a focus on public health and primary care is necessary to help us deal with this problem, but it will not be sufficient.

Instead, we need to carefully consider new care requirements and approaches that are quite different from what we have today. Before I talk about the changes that we should think about and consider implementing in the future, I shall set the context by alluding to some of the things that MOH has planned and is in the process of implementing. Perhaps the best summary of this comprehensive set of strategies is found in Minister of Health Mr Gan Kim Yong's speeches on the Committee of Supply (COS), particularly the speech in 2012.[6]

To summarise, MOH's vision for Healthcare 2020 revolves around three major pillars. The first is enhancing access, which involves expanding infrastructure such as physical buildings and engaging the private sector. It is about growing and retaining healthcare professionals in the public sector, followed by improving quality of care through greater integration. This is the rationale for the Regional Health Systems' development, the National Electronic Medical Records and other enablers. Secondly, a greater focus on primary care by engaging and supporting general practitioners (GPs) through family medicine clinics and the extension of the Committee Health Assist programme (CHAS). Finally and importantly, it is about improving affordability, which involves fundamental shifts that are very critical. The first shift is that the government is taking a greater share of the overall national health spending, from about one-third in 2012 to about 40% currently. Also, there is a shift of financing from inpatient to primary care and long-term care, as well as a greater role for insurance, particularly MediShield Life. At the same time, as Minister Gan rightly pointed out, we need to manage increases in healthcare costs, and one of these elements is the retention of patient co-payment, for the reason mentioned earlier – we should not send the bills to our grandchildren. Against this background of a comprehensive set of strategies from MOH, I ask the question, "What more can or should be done?" and "Are there opportunities for us to not only address today's problems but to leapfrog?"

WHAT MORE CAN OR SHOULD BE DONE?

I shall now tell a well-known story of two doctors walking by a river. As the story goes, there are two doctors – let's say one is an anaesthetist and the other a physician – walking by a river. They find a person being swept down the river and struggling in the water. The anaesthetist jumps in and helps the person out, but before long, another person comes floating down the river. She jumps in again, pulls the person out and repeats the same process. After some time, the anaesthetist, who is by now

getting tired, notices that the physician is nowhere to be found. After a long time, the physician finally returns. The anaesthetist, who is still jumping in and out of the river saving people, asked the physician where he had been. The physician said, "I went upstream to find out why people are falling into the river." It turns that the people upstream have been crossing the river by holding a rope, and some have fallen into the river.

The point of this story is that, while we are trying to fish people out of the river, we should also go upstream to discover why people are falling into the river in the first place, and perhaps build a bridge or find a safer way to cross this river, so that people will stop falling into the river, thereby reducing the need to pull them out of the water downstream.

Today, we spend a lot of our time optimising healthcare for the present. Many of the steps that we have taken across the healthcare system are aimed at right-siting to primary care or step-down care. One of these steps, enhancing healthcare financing, is a critical part of it. Another important piece is innovating for greater hospital productivity and care quality, for instance, seeing more patients with greater effectiveness, or using the same or a fewer number of trained people. This is happening throughout the healthcare system, and it tends to revolve around automation, the use of information technology (IT), workflow improvements and changes in care delivery approaches. There are innovations across the entire Singapore healthcare system – in KTPH, Tan Tock Seng Hospital, Changi General Hospital, etc. Since I am more familiar with the National University Health System (NUHS), please pardon me for illustrating with a couple of examples from NUHS. Automation and IT are very important for improving productivity. Almost everyone's labs, whether public or private, are fully automated. We have COWs (Computer-on-Wheels), computerised patient support systems that can be pushed around. In most of our hospitals, we also have completely automated pharmacy systems – from order entry to robotic dispensing to inventory and management. All these result in tremendous savings in manpower usage.

We also improve on workflows. This is an example of the medical department and emergency department working with the National University Heart Centre in NUHS. The problem they were trying to deal with was the relatively large number of people being admitted or referred to the specialist outpatient clinic (SOC) from the emergency department because of chest pain or angina. In the preceding year, more than 1,000 of such patients were referred or admitted. The solution was quite straightforward. Conduct upfront stress testing – either a treadmill test or MIBI (myocardial perfusion) scan – in the emergency department. By maintaining the same clinical care quality, we were able to cut down SOC visits by more than 40% per week and admissions per day by 40%. So, making changes to the way we deliver care and organise our workflow is important.

We can also improve on work processes. One such improvement is the macerator. Those of us who have had to clean bedpans know that not many people will volunteer for the job. The macerator is a disposable system that uses bedpans made of newspaper pulp, which is quite durable. After use, the bedpans are placed into the macerator, which disintegrates them. That's it – one-use, macerate, finish. It results in a lot of time and energy savings, and the nurses are much happier. The patients may also be happier, as the commode is used only once and disposed of.

We can also improve productivity by changing the delivery model. Here is an example of the patient-centred medical home at NUHS, through the Frontier Family Medicine Clinic. I shall illustrate this using a patient who had very high blood pressure and required many consults and admissions. By moving the patient to the patient-centred medical home programme, he was able to achieve the same or a better level of care, along with a reduced need for physical visits and inpatient stays. Most of the interactions were through email and telephone contact. In other words, before he entered the programme, he had multiple visits to the GP and 17 visits to the SOCs at National University Hospital. After the programme, it reduced to six and five, respectively. From three visits to the accident and emergency department and four hospital admissions, these became zero. Therefore, by changing the way care is delivered, we can achieve big savings in hospital bed usage and greater convenience for the patient, yet maintain the same care delivery quality.

All the above-mentioned are already being done in hospitals and clinics throughout Singapore. We need to continue to utilise technology and innovations, in order to increase our productivity and make better use of our resources. As mentioned earlier, we should not concentrate only on fishing people out of the river, but also go upstream to look at the more fundamental causes of the high burden of disease and try to think of fundamental solutions for tomorrow.

IMAGINING THE HEALTH SYSTEM OF THE FUTURE

This leads me to the next segment of my presentation, which is really about imagining what the healthcare system of the future will look like. Now, the word 'imagining' sounds rather grand. In my limited imagination, I see the future of healthcare as bringing many elements together in an integrated whole in order to change the way we deliver care. If we think about health needs of patients or the community, it revolves around a stronger focus on bringing together different elements – from public health and clinical care imperatives – to giving a much greater role to laypersons to receive some form of training that would allow them to contribute to care delivery. This may include using low-cost technology, making changes to the finance and economic settings, and making better use of behavioural sciences.

Before I talk about how one might try to integrate these elements, I will briefly look at examples of some of the component parts. How does each of these different parts that I alluded to look like operating by itself? The first example is public health and clinical care imperatives. How do we use new disease management approaches to positively change outcomes, in a fundamental and not just an incremental way? The early psychosis intervention programme, spearheaded by Prof Chong Siow Ann from the Institute of Mental Health (IMH) and supported by MOH in 2001, is a very good example of this. The problem that

Siow Ann and his team were trying to address was the issue of late diagnosis of psychosis, in particular schizophrenia. On the average, it took nearly three years before someone who had symptoms was diagnosed. Because of the late diagnosis, treatment was delayed and the patient suffered substantial disability. Many of these individuals ended up in short-term stays and some would eventually stay for decades in long-term care institutions. To address this problem, instead of building another IMH, the team decided that they needed to detect patients early. To do so, they educated the general public and created a wide network of community partners, including GPs, counsellors, traditional healers and military personnel, who were taught how to identify some of the early symptoms of psychosis. People identified as potentially psychotic are then referred to a number of specialised clinics to be diagnosed. Once diagnosed, treatment can be started early. This whole process was underpinned by rigorous research.[12-14] Results showed that among patients who were accepted into this programme in 2007–2011, over 70% achieved symptomatic remission after two years. This compared favourably with data in other published studies. More than three-quarters of patients returned to work or were employed, and patients who needed short- and long-term hospitalisation were vastly reduced. By changing the way they delivered care, Siow Ann and his team were able to change a model that merely responded to people in the river, picked them up and put them into long-term institutional care.

The second example relates to expanding the role of trained laypersons. Medical students from the National University of Singapore (NUS) Yong Loo Lin School of Medicine have been running a neighbourhood health screening programme for the past five to six years. This programme is completely student-run. Three times a year, the students visit 500 households living in rental flats in Taman Jurong. Besides conducting health screening, they also help patients who have chronic diseases improve their medication compliance through education. One project they took up was blood pressure control. Among the 1,700 residents who lived in public rental flats, blood pressure control improved from 27% to 73%, and these data were published in Academic Medicine, a respectable journal.[15] These are just Year 1 and 2 medical students. While they are smart and very motivated, they are still effectively laymen, not physicians. Therefore, with adequate amounts of training, well-motivated laypersons can achieve good results in such situations.

The third component is finance and economics as drivers of change in the right direction, which is very critical. The example I want to cite is Minister Gan's initiative on CHAS, which he discussed in his Community of Supply speech in 2012.[6] As we are well aware, CHAS is a scheme that enables patients to receive subsidised care at GP and dental clinics. In January, the criterion for per capita household income was raised from $800 to $1,500 and the minimum age was lowered from 65 to 40 years old. This change in criteria made it easier for patients to be eligible for the programme. This represents a change in the funding policy. The outcome was a doubling of the enrolment in the scheme from 38,000 to 77,000 members within two months. When the minister provided an update in his COS speech in 2014, the number of patients on CHAS had gone up to nearly 600,000,[7] a 15-fold increase. Thus, a change in finance policy can lead to a very large change in the way people react and respond. This is also vital because it marks an important shift. In the past, we relied on a largely site-specific government subsidy system. In other words, if you go to a polyclinic or restructured hospital, you get a subsidy, but if you go to a GP or private hospital, you get no subsidy. CHAS and its predecessor, however, are person-specific subsidies, which mean that if you are eligible, the subsidy is portable. This is an important distinction, as a person-specific subsidy allows the eligible person and the health provider to mobilise or make better use of private facilities under certain defined conditions, thus enlarging the types of treatment facilities available to patients. That was a policy direction that enabled more patients to receive subsidies in primary care, as well as moved the subsidy system from one that is site-specific to one that is more portable and person-specific.

The fourth example is a very fascinating area – the behavioural sciences. There has been an explosion of behavioural sciences and its application to all kinds of things – from why people litter to the way people think about healthcare. This understanding is helping us to think about how to help people adopt behavioural changes in the right direction, usually with incentives. However, we cannot just keep giving people incentives. So, how do we move from incentivising behavioural change to positive habit formation? Also, if enough people in the community develop a certain habit, how do we make it a social norm? Let's take smoking, for instance. Today, if we see someone smoking, most people tend to look at it disapprovingly. This is not because we are doctors, but because it is not the social norm to smoke now. So behavioural sciences does provide us with rich information on how we can do this better. In fact, we are just catching up with the marketers, people who got us to drink more coke, eat more McDonald's, and so on! The principles are the same.

As you can see, the component parts are already in operation. The question is how to put all of these components together in an integrated and coherent way. To deliver healthcare differently and to transform it – that is the principal challenge. In addition, we need to bring them together in a way that accomplishes these critical goals: the same or better quality of care; the same or lower cost; fewer healthcare professionals being utilised; and high patient and public acceptance. In other words, we have to bring these components together coherently in a way that makes clinical sense, produces good outcomes at lower costs, utilises fewer manpower and is acceptable to the public. The question, 'How do we do this?' remains to be answered.

One way is to use public health approaches to deal with health promotion, disease prevention and population health issues. If you look at the hospitals today, quite a number of patients with non-complex diseases are being referred to the SOCs, although it would be better if they were seen outside. Most of the time, we refer these patients to a GP, which is the current model. However, in the future, we need to transfer them to supervised empowered care in their own homes. Then there are

the high hospital users and frequent admitters, a small percentage of patients who account for a disproportionate use of resources. In NUHS, for example, 8% of patients account for 28% of hospital bed-days usage. If we focus on this 8% and reduce it by half, then we can theoretically release another 14% of hospital bed-day capacity. Many of these patients, I believe, could well be treated at home under supervised empowered care.

So, when we imagine the health system of the future, the majority of care will be carried out at home and enabled by low-cost technology. It has to be low-cost, otherwise it cannot be scaled. We will have to make use of family members and voluntary helpers in order to deliver the care, assisted by medical decision support systems in the future. In some cases, it would not be possible to treat the patient solely at home. For these individuals – whether patients in need of inpatient care for non-complex conditions or elderly patients with multiple illnesses – we may need to consider holistic care centres. These centres will be staffed by GP-led care teams and designed around optimising functional recovery. What this means is when an elderly patient with multiple illnesses is seen, we do not only treat that particular disease that brought the person to the centre, whether it is pneumonia today or a small stroke tomorrow. We need to understand what the final endpoints are, as well as what we want to achieve with the patient and family consultation.

How might this work, you ask? I propose that patients with non-complex single/multiple conditions, frequent admitters and elderly patients with multiple medical problems could be looked after by primary care teams with a small number of primary care doctors, supplemented by a small group of healthcare coordinators and aided by low-cost technologies, volunteers and caregivers. From a primary care team point of view, each team must be able to see substantially more patients than if they were operating under the current face-to-face consultation model. We will likely need to have a five- to ten-fold increase in the number of patients in order to achieve the scale to deal with the size of the problems that we will face. Further, if patients require inpatient care, they could be referred to holistic care centres, where the care pathways will have been redesigned to optimise and promote functional recovery. The idea is not to merely treat the patient and fill up the facilities so that we have to build more and more of them. Over time, these facilities will just become like another community hospital. We need to redesign care pathways so that functional recovery is accelerated, and also make use of caregivers and volunteers early, preferably after the acute phase, to help with that transition. It is also important to deploy frugally designed technology. Today, we have lots of technology for monitoring patients, for instance. When all the technology is put together, it becomes an intensive care unit, which is simply too expensive and unfeasible to be deployed. The key is frugally engineered technology that is low-cost, easy to implement, and does not require significant training to operate.

I wish to stress that when we deploy low-cost technology, it must not become an end in itself. The main idea is to save labour in terms of monitoring, recording, treatment-assistance, so that health professionals can look after a larger number of patients at one time, and have more time to focus on human-to-human care elements and lead delivery teams, which must remain at the heart of clinical treatments. How might this work?

I shall give you examples of technologies that are already available today. When I was visiting the NUHS research institute in Suzhou, I came across this fibre bed, which was invented by one of our doctors and an electrical engineer there. This bed had won a top prize for innovation in China. The bed is able to measure a patient's heart and respiratory rates while the patient is lying on it, as well as display the results. This is how it works. Embedded in the bed are optic fibres. When the patient lies down, the pressure deforms the fibres, creating differences in the output, which is recorded as changes in heart rate and respiratory rate. There is also a fibre chair that works the same way. They are now working on a bed that can measure electrocardiogram (ECG). Recently, I read in the newspapers about a 300-kg bed that is powered by a motor and can be pushed with one hand. Since we have driverless cars these day, perhaps one day, we will also have driverless beds or electroencephalogram (EEG)-controlled wheelchairs for people with stroke. I have already seen some very workable models, such as brain-controlled wheelchairs that take about half an hour to learn how to operate. While waiting for the technology to be ready for a fibre bed to measure ECG, we already have an NUS start-up that produces digital ECG plasters. The plaster, which you stick on the patient's chest, has no wires, and can record and transmit a 12-lead ECG. Because of its low power requirements, the plaster can transmit for five days at a time. When you are finished with it, you throw it away and put on a new one.

In the same way, we can have low-cost and simple wearable devices. Imagine a t-shirt with an inbuilt blood pressure monitor and pulse oximeter that measure and transmit wirelessly. Though I have not seen any example of such a technology yet, I think it is a perfectly solvable technical challenge. Nowadays, spirometers can be built at a cost of less than ten dollars per piece, and they can also be easily enabled by Bluetooth to measure the peak expiratory flow rate. All the data can be stored in the cloud; we do not even need computer screens. Gone will be the days when COWs are pushed around with people crowding around computer screens and wondering which panel to look at. There are now three-dimensional visualisation glasses that can conjure up holographic panels. Imagine, the whole team can see panels with blood pressure results or patients' treatment profile while discussing the patient, without the need for hardware or terminals. In rehabilitation, assisted exoskeletons are already in existence. The NUHS knee-ankle assisted device is currently part of a study. A large number of universities are also developing simple exoskeletons. Although there are still technical issues, particularly control and balance issues, which need to be worked out, I am quite confident that these issues will be solved in the coming years. As you can imagine, with exoskeletons, physiotherapists may be able to assist ten patients in rehabilitation at one time.

As mentioned, some of these examples of technologies are already present. However, we need to make them much cheaper and simpler to use, and more critically, incorporate them into new

category models, so that the physician team can re-conceptualise systems that are technology-enabled and not allow technology to drive the way patients are being looked after. There will, of course, still be a role for acute hospitals. Hopefully, they will be ready for high-complexity patients and those who need subspecialty or high-tech care in the future.

It is very easy to talk about these technologies and improvements, but we all recognise that there are many challenges ahead. However, I think we need to at least make a start at it. There are, however, some fundamental things that go beyond technology and clinical care components that will decide whether these things can happen or not. One important issue is trust. Why are we doing all of these? If people think the sole purpose is to cut costs, then there will be severe impediments to future progress. The main thrust is to deliver as good or even better quality care, with greater convenience and at lower costs for the patient and health system. That is the value proposition that will enable the building up of trust, which is critical in the public sector. Therefore, research and data on outcomes and cost-effectiveness are very important, as they assure patients that what we do is beneficial for them and the health system. Along the way, health financing changes must also be made to enable us to make these changes. We will not be able to deploy the systems together if we are unable to charge for them.

Let me summarise by saying that the greatest challenge, in my view, is not the development of component parts, as many have already been developed, assembled and implemented. The real challenge is bringing them together in an integrated and coherent way. This addresses the central issues of quality, productivity, cost and acceptance in the face of sharply rising demand. To overcome this challenge requires a long-term vision for change, as well as excellent coordination and a sustained, tenacious commitment to make it work. Finally, as physicians, we must all ensure that compassion and the human touch remain a central part of medicine – something that SMA has always championed.

CONCLUSION

With that, I would like to end with two quotes. In an article published in the *SMJ* in 1997, Dr Wong Heck Sing said, "*Times change. Yet, certain fundamentals remain constant.*"[16] In 1903, William Osler observed, "*The times have changed, conditions of practice have altered and are changing rapidly... but we find the ideals which inspired them are ours today, ideals which are ever old, yet always fresh and new...*" In other words, the fundamentals for the practice of good medicine never change. We need to transform the way we deliver healthcare, but the fundamentals – compassion, altruism, patient-centredness and putting the patient's interest first – remain at the core of what medicine is fundamentally about.

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About the Lecturer

Prof Tan Chorh Chuan graduated with an MBBS from the National University of Singapore (NUS) in 1983. After completing his National Service, he went on to do Internal Medicine in the University Department of Medicine, winning the Gordon Arthur Ransome Gold Medal as the top candidate in the Master of Medicine (Internal Medicine) examination. He specialised in Renal Medicine and won a Commonwealth Medical Fellowship and Wellcome Fellowship to do his NUS PhD on erythropoietin at Oxford. He was also a visiting scholar to Wolfson College. Prof Tan was appointed President of NUS in December 2008 and concurrently serves as the Chairman of the Board of NUHS. Prof Tan's additional appointments include Deputy Chairman of A*STAR, Senior Advisor to the Governing Board of Duke-NUS Medical School, and Member, Board of Directors of the Monetary Authority of Singapore.

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