Roche

Dia:gram

Diagnostics
in the Shadow
of COVID-19

More Preventative,
More Powerful:
the Future of
Precision Oncology
PROF DAVID THOMAS

Pg8

Cracking the Health
Utilisation Paradox
PROF CAI JIANGNAN

Pg12

PROFESSOR WOO YIN LING

The Financial Case for Better Clinical Healthcare

**"When the clinician is confident,
the patient will be confident with the test."**

Pg19

Note from the Editor

Dear Readers,

COVID-19 has forever changed the way we prevent, detect and manage diseases. As health systems redesign delivery models, patient-centric care will be crucial in not only improving health outcomes, but also helping to reduce healthcare costs and the burden on health systems.

In this issue, we speak to experts such as Prof Cai Jiangnan from China to discuss the mental shift needed to craft a preventative healthcare system. Prof David Thomas from Australia explores the exciting potential in next-gen cancer treatment and we explore how clinicians can optimise costs and improve accessibility with Prof Woo Yin Ling from Malaysia.

For these stories and more, dive into our latest issue of Diagram.

Shruti Bose

Contents

As COVID-19 mutations evolve and cases flare up again across the region and the world, the uncomfortable truth is clear — COVID-19 is here to stay.

The Future of Health Systems in the
Shadow of COVID-19

Against the backdrop of COVID-19, preparing for the unexpected must become the norm.
It is time for diagnostics to help co-create an ecosystem that is more agile, effective and innovative.

When the first wave of COVID-19 rose like a tsunami, the world was unprepared.

Suddenly overwhelmed healthcare systems were at the brink of near-collapse, healthcare workers and laboratory staff had reached a breaking point.

Yet, in the face of this onslaught, formed a never-before-seen wall of human resilience

and unity. Governments, industry, academia and civil society came together to tackle the pandemic head-on.

As COVID-19 mutations evolve and cases flare up again across the region and the world, the uncomfortable truth is clear — COVID-19 is here to stay. As many experts have predicted, it will become endemic, repeatedly surfacing,

in different places and different ways, for the foreseeable future.

The most significant impact of this will be felt in three key areas:

1. Financing Care
   Rethinking Disease Management as COVID-19 Becomes Endemic
   The challenge, therefore, is how
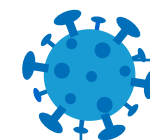
In January 2021, Nature asked over 100 COVID-19 experts whether the disease could be eradicated.

89%

said it would become endemic.*

*Phillips, N. (2021). The Coronavirus is Here to Stay — Here's What That Means. Nature. Retrieved from https://www.nature.com/articles/d41586-021-00396-2

healthcare systems will arm themselves against these recurring waves. In 2020, when early studies suggested newly developed vaccines were effective against COVID-19, the world breathed a sigh of relief — but perhaps too soon.

Months on, the roll-out of vaccines has not been as quick as hoped and newer, more virulent strains have continued to chip away at the world's defences.

With no silver bullet in sight, health systems must find other ways to manage disease control and provide care in unusual times. However, health system preparedness cannot function in a vacuum. Equally important is infrastructure resilience as an Organisation for Economic Co-operation and Development (OECD) paper suggests, "It is also important to look beyond the context of the current crisis — to how infrastructure can be made more resilient across multiple dimensions in the face of numerous threats and risks."

This requires policies that ensure sustainability in health financing — the ability to lessen economic hardships while safeguarding health, without sacrificing one for the other. By doing this, countries can strengthen their ability to fund long-term strategies including the implementation of universal health coverage (UHC), which is well under way in many countries across Asia Pacific.

2. Delivering Care
   Maximise the Potential of Remote Care in Global Health Systems
   The benefits of continuity of care cannot be overstated. Teleconsulting, virtual tumour boards and digital pathology have kept healthcare systems moving when face-to-face interactions have not been possible.

With health system redesign at the top of policymaker agendas, the question now is, how can these early set-ups be embedded and improved upon?

As the same OECD paper suggests, "Many governments have included infrastructure spending as part of stimulus in response to the pandemic, resilience will be a key element to consider when planning and prioritising investment, especially in the context of technologies and innovations that could enable lower cost and digitally enabled solutions."

To support the uptake of such technologies, and to generate Real World Evidence (RWE), Taiwan's National Health Insurance (NHI) under the Ministry of Health and Welfare, has formally included telemedicine in the reimbursement coverage from 2021.[1]

Changes to Surgical and Clinical Guidelines
As infectious disease guidance changes, front-liners must be kept abreast and able to implement new steps quickly, such as more rigorous pre- and post-surgery testing.

However, in a time where outbreak spikes can swamp hospitals, any tools that can help ease manpower shortages are a boon. For example, hospitals have long been tied to slow, invasive, painful methods to get patient arterial blood gas values. Now, digital methods can help monitor the respiratory state of dozens of patients per hour and

be administered easily.[2] This frees up specialist staff for more complex matters. At a time when the World Health Organization (WHO) estimates a projected shortfall of 18 million health workers by 2030,[3] mostly in low- and lower-middle-income countries, care delivery teams will need all the help they can get.

With no silver bullet in sight, health systems must find other ways to manage disease control and provide care in unusual times.

Similarly, the adoption of diagnostic technologies that can help to quickly triage patients will become increasingly routine. In the early stages of the pandemic, doctors were hampered by the fact that COVID-19 and normal flu-like symptoms were similar, handicapping effective treatment and quarantine measures. Thankfully, using point-of-care tests that help to differentiate between coronavirus and flu strains in as little as 20 minutes,[4] can prove to be an effective strategy.

Ease Pressure on Emergency Departments (ED)
Cardiovascular emergencies account for approximately 10 percent of Emergency Department visits.[5] With the rapid surge of emergency cases brought on by global health emergencies as seen during COVID-19, ED clinicians need to rapidly differentiate between life-threatening conditions and non-life-threatening ones to free up hospital beds and accurately determine which course of treatment can support optimal patient outcomes.

Cardiovascular diseases are responsible for 17.9 million deaths every year,[6] a third of all deaths globally. The use of cardiac biomarkers can help to help identify cardiovascular risk, better diagnose patients and support early treatment. For instance, NT-proBNP is considered a gold standard in heart failure diagnosis and management, and can support healthcare professionals in identifying which people with type-2 diabetes are at higher risk of developing cardiovascular disease. Early identification of people at risk means cardioprotective treatment can be started sooner, which could prevent 65 percent of hospitalisations or deaths.[7]

Another important biomarker, high-sensitivity troponin T, provides healthcare professionals with data to help predict heart attack risk and mortality in non-cardiac surgery patients. Every year, over 200 million adults undergo major non-cardiac surgery with 10 million suffering

from major adverse cardiac events (MACE) that could be prevented through early and accurate diagnosis.

**3. Patient at the Centre of Care
   Empower Patients to Take Control of their Health through Self-test Options**
While wearables and embedded sensors are not new, individuals do not have an active role to play in generating data. However, the introduction of new self-test kits for COVID-19 or self-sampling for cervical cancer screening, are creating a shift in the role of the patient, giving them more involvement in the testing and screening process.

In Singapore, rapid antigen testing has become available over-the-counter at pharmacies, offering another avenue to quickly identify infectious cases, without the need for professional testers[7] and physical centres.

However, this evolution of testing must be balanced by confronting new risks with a comprehensive testing strategy. As Singapore's Ministry of Health cautions,[8] people must remain vigilant and those with Acute Respiratory Infection (ARI) symptoms should visit a doctor for a full diagnosis and PCR test instead of relying on a self-test kit.

**Bracing for the Unexpected:
Building Resilience and Adaptability for Oncoming Pandemic Waves**
While progress has been made in sequencing COVID-19 and creating vaccines in a short time, much is still unknown about how it affects other diseases.

In the coming years, we will keep learning of unexpected ways that health conditions

interact with the novel coronavirus, as well as unknown diseases that are yet to surface. While the buzzword for the health industry in 2020 was "resilience", as we

move to the next stage of the pandemic and take cautious steps towards the future, we will have to embrace another quality in the ecosystem: adaptability.

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How Precision Oncology is Transforming Patient Care

by Professor David Thomas

The days of one-size-fits-all cancer care are over: Professor David Thomas, Director of the Kinghorn Cancer Centre and Lab Head of Genomic Cancer Medicine at the Garvan Institute of Medical Research in Australia, shares why.

Every person is unique, and so is every cancer. As a fundamentally genetic disease, the genomic profile of each cancer tumour is unique and determines the specific mutations that drive the cancer's growth.

Rapid advancements in the field of precision oncology over the past decade have given us the ability to use genome sequencing to predict how a patient's cancer will respond to existing treatments, such as surgery or drug therapy. Meanwhile, innovative digital health technologies that provide us with new ways to collect and analyse patient data using AI-driven algorithms have also emerged.

The effects of these are transformative. Patients no longer have to suffer treatment that is unlikely to work, and it takes the guesswork out of clinical decisions which means effective treatment, reduced healthcare costs and better clinical outcomes.

Optimising Treatment Through Genomic Medicine

Genomic medicine is the future for all cancer treatment, but will have its most significant impact on rare, high-mortality cancers like sarcomas and cancers of unknown primary.[1] In this arena, it is a complete game changer. Few therapeutic options currently exist for such patients due to the difficulty in diagnosis, the ineffectiveness of standard treatments and limited access to new therapies.

There are approximately

100,000 mutations

found in some types of lung cancers.[*] Now, tumour and genomic profiling, combined with advances in diagnostics like liquid biopsies, enable the monitoring of lung cancer patients, detecting disease progression and identifying those likely to respond to tyrosine kinase therapy.

*Strachan, T., Goodship, J., & Chinnery, P. (2015). Genetics and Genomics in Medicine. European Journal of Human Genetics, 23(5). https://doi.org/10.1038/ejhg.2015.18

> *"My prediction is that genomics and precision medicine will increasingly spread out across the entire cancer journey in the pre-diagnostics space — where we might be able to identify people at differential risk and screen for them."*

Previously, lung cancer was a disease with a very low treatment response rate. Now, up to half of all patients with lung cancer have the possibility of receiving treatment, which will make a massive difference to their survival.

Another example: identifying the KIT proto-oncogene target in gastrointestinal stromal tumours and discovering targeted therapeutics that work against that molecule has transformed survival rates for that disease. What's more, it has opened up treatment options which have never existed before.

Equalising Access to Genomic Medicine

Precision oncology can improve efficiency of care and cut the number of ineffective treatments prescribed — particularly for billions of people in Asia Pacific. Asia Pacific is a large

and complex region that has undergone rapid change over the past half-century. In addition, it contains a diversity of ethnicities, governments and health systems. Taking all of that into account, Asia-Pacific will be an enormously vital influence in global health.

For that to happen, the regional healthcare ecosystem needs to be tailored to clinical challenges faced by cancer patients in Asia Pacific as well as to the various national healthcare systems involved. For instance, cancer is a significant cause of mortality in Australia, Singapore and South Korea — as it is in most higher-income countries. But you also have countries like Papua New Guinea, where communicable illnesses, neonatal mortality and infectious diseases are the major causes of death instead of cancer. Over the next 20 or 30 years, we will likely see enormous demand for genomics in the region, as

the implementation of precision medicine rises in tandem with affluence.

As cancer risk is often genetically determined by genomic profiling of the germline, wider population-level screening availability in Asia Pacific may result in increased personalised risk management. My prediction is that genomics and precision medicine will increasingly spread out across the entire cancer journey in the pre-diagnostics space — where we might be able to identify people at differential risk and screen for them.

Prevention, early detection, curative therapy and personalised treatment of advanced cancers will all be affected by genomics and targeted therapies. I cannot think of an area of cancer care which will not be relevant for optimal treatment of patients going forward, in Asia Pacific or elsewhere.

[1]About | Garvan Institute of Medical Research. (2019). Garvan Institute of Medical Research. Retrieved from https://www.garvan.org.au/research/genomic-cancer-medicine-program/about

"If you have a government tied to a term of a few years, then that limited time span is really when they want to see change happening."

— Professor Cai Jiangnan, Director of CEIBS Centre for Health Care Management and Policy, and Adjunct Professor of Economics

The Health Utilisation Paradox:

Incentivising Diagnostics Uptake

The creation of more preventative health systems is possible, says one expert.
In order to do so, we need to overcome stubborn biases and short-term thinking.

Human civilisation has lofty aims of perfection, but at the end of the day, we are hampered. Not by technology but by psychology. Lapses of logic known as cognitive biases are common throughout life, and, that includes healthcare policymaking.

Even in this crucial arena, many decision makers are still mired in the wrong ways of thinking. Like measuring success in terms of "sick care" — treating diseases only once they have entirely reared their head — rather than preventing diseases in the first place. Professor Cai Jiangnan, Director of the China Europe International Business School (CEIBS) Centre for Health Care Management and Policy and Adjunct Professor of Economics, has decades of experience shaping medical policy in China and the United States. He shares how bias, blind spots, and fallacies can slow the pace of true healthcare evolution.

Many expect health policymakers to be wise, perfect beings. But mistakes can happen in any industry. Do you have any examples you can share of how illogical thinking has shaped healthcare delivery?
Yes, definitely. Let me give you an example. About 10 years ago, the Chinese government wanted to strengthen primary care by ensuring that doctors were

satisfied with their job and protecting their income. So what did they do? They guaranteed their salary and delinked their income with their revenues. But what was the effect that stands to this day? Primary care doctors suddenly have no incentive: no matter how hard they work, their income is pretty much the same across the board. So, a lot of good doctors want to move out of primary care. And for the past 10 years in China, it's become a big problem for the primary care sector; it can't attract good talent.

That leads to another effect: patients trust primary care less because they feel the doctors are less capable. All of this stemmed from an original good intention: a policy to protect primary care — yet it achieved the opposite results.

What part does diagnostics play in helping a health system become more prepared for healthcare issues?
COVID-19 has taught everyone, from everyday people to governments, that testing is the first link in a chain that leads to early treatment. And if adequate testing isn't there, then medical costs can soar.

However, I have to emphasise that there is a big "but". And that "but" centres around the need to change people's behaviours

and correct another bias. As a consequence of human nature, people tend to be short-sighted. If people are diagnosed with a fast-acting disease, they will take serious action to prevent it. But if the water is muddier and timelines less clear, people become complacent. You only have to look at the number of people who know smoking is linked to cancer and smoke anyway to realise that.

So to truly change people into a preventative form of mind, you have to change behaviour. You have to mobilise society from the ground up to internalise the idea that early disease prevention is vital. Patients should learn this, and governments should support patients on that journey. Consumers are willing to get a COVID-19 test because it's, in a sense, life or death. "If I don't get a result on this, I may die in a few weeks," people know. But things are different for longer-term health problems. They're less willing to get tested for something that may affect them in a few years or decades. Finding a solution to this area, perhaps through training general practitioners to educate their patients, has massive potential to unlock true healthcare change. And behavioural change must go hand-in-hand with strengthening lab infrastructure and capabilities, so that as testing demand increases, the resources to handle it are more than adequate.

Value-Based Healthcare

Improved cost-effectiveness and health outcomes as a result of timely diagnosis and interventions bring value to healthcare systems and stakeholders. The use of diagnostics supports value-based healthcare (VBHC) in maximising quality improvement per dollar spend.

Michael Porter, the renowned economist defines patient value as **"patient-relevant outcomes, divided by the costs per patient across the full cycle of care in order to achieve these outcomes. Value-Based Healthcare focuses on maximising the value of care for patients and reducing the cost of healthcare"**, in his book *Redefining Health Care: Creating Value-Based Competition on Results[1].*

$$\text{Value} = \frac{\text{Quality}}{\text{Cost}} = \frac{\text{Outcomes + Patient Experience}}{\text{Direct Costs + Indirect Costs}}$$

Benefits of Value-Based Healthcare

Patients	Providers	Payers	Suppliers	Society
Lower costs & better outcomes	Higher patient satisfaction rates & better care efficiencies	Stronger cost control & reduced risks	Alignment of prices with patient outcomes	Reduced healthcare spending & overall better health

- VBHC does not solely focus on discrete treatments but the complete care cycle, as it consists of health outcomes aggregated from the entire care cycle and the associated total cost that makes up the end value[2,3,4].
- VBHC is seen as a potential solution to unsustainable rising healthcare costs[4].
- VBHC can also encourage patient-centric care as providers are paid based on the value of outcomes produced rather than the individual service provided[2].

Opportunities with the implementation of VBHC

- Deeper understanding of the burden of disease[9]
- Administration of targeted therapies to improve health outcomes[10]
- Use of digital health technology to better track and monitor patient and health outcomes in real-time[11]
- Innovative payment schemes and outcomes tendering[2]

Challenges associated with the implementation of VBHC

- Alignment of financial incentives across industry sectors[12]
- Change in practices and the adoption of digital tech[11]
- Requirement for high quality and seamless healthcare infrastructure[11]
- Optimization and interpretation of electronic health record data[13]
- Collection and reporting of quality measures[14]

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3 BIASES THAT CAN AFFECT MEDICAL DECISION-MAKING AND POLICY*

1. **Confirmation bias** (cherry-picking from events and facts to support your already established conclusion)

2. **Bias blind spot** (being unaware of your own biases)

3. **Anchoring bias** (over-reliance on a single piece of data)

*The National Academies of Sciences Engineering Medicine (2015). Measuring Human Capabilities: An Agenda for Basic Research on the Assessment of Individual and Group Performance Potential for Military Accession. Retrieved from https://www.nap.edu/read/19017/chapter/7

Have you seen any interesting government measures that "nudge" citizens towards testing and prevention?
Yes, in China, the government has played a crucial role in vaccinations. Positive incentives, even small gifts in the form of cooking oil for people who show up to get their jab, have been a powerful showcase of how the government can change behaviour for the better.

Another incentive is in changing the payment system. Like grouping preventative treatment so that patients can keep the savings. You incentivise the provider to make more preventive diagnoses. Instead, the system is geared around "sick care": it's usually when people are sick that they get treatment and insurance reimbursement for that sick care, rather than creating a system where people are rewarded for seeking preventative care.

In Shanghai, we are currently running an experiment where elderly patients pay a single lump sum to the healthcare provider ahead of time. And what we want to find out is, if providers are tied to this sum and no more, are they incentivised to keep people well and thereby keep the remaining savings?

What other ways of thinking can create hurdles in the world of health policy?
Well, it's apt that we're talking about bureaucracy and reluctance to change behaviour, because that is an issue in many countries. Government staff might be illogically tied to older ways of doing things. Another issue that nations face is, if you have a government tied to a term of a few years, then that limited time span is really when they want to see change happening, which is in a way understandable. If we can get policymakers around the world to grasp the value of "paying it forward", to help — indeed, all of society — in the long-term, then we can start to see real exciting change.

How Do We Implement
Value-based Healthcare?

Healthcare costs have to be proportional to the derived value. We explore strategies that can shape value-based healthcare around the world.

Doing more with less has never been more critical to the delivery of healthcare than in the shadow of COVID-19. Healthcare costs, which had been spiralling out of control for years, have hit public coffers especially hard. Even the most developed economies are nearing the limit of what they can afford to spend on healthcare, while developing health systems don't have the necessary resources to manage large patient populations.

Until Professor Michael Porter and Professor Elizabeth Teisberg first proposed the concept of value-based healthcare (VBHC) over a decade ago, the focus had been on the cost of providing treatment.[1] But the current health emergency seems to have revived interest among healthcare experts and policymakers.

Prioritising Value Over Volume
At its core, value-based healthcare aims to address two goals — improving health outcomes and reducing unnecessary costs.

Value for patients, as put forth by Professors Porter and Teisberg, should not be determined by factors such as site of care, medical specialities or even procedures. Rather, patient value is better defined as patient-relevant outcomes, divided by the costs across the cycle of care to achieve these outcomes. In other words, the VBHC model focuses on maximising the value of care for patients at the lowest cost possible. It might not seem revolutionary, but this patient-centric strategy is a noticeable shift from supply-driven approaches where patient volume and profitability take precedence.

However, it's not always about saving money. Weighing in on this topic is Dr Christina Åkerman, Affiliate Faculty at the Dell Medical School, University of Texas. "If you do not deliver on the outcomes, it doesn't matter how low the cost is because the value will still be zero. Outcomes that matter most to patients are the true North Star in achieving high-value care."

Dr Åkerman, a leading expert who has been instrumental in developing a global and common set of measurements for determining the success of care adds emphatically, "We need to ask patients 'what matters most to you?'."

In Asia Pacific, the needle is moving, slowly but surely, from volume-based payment models to value-based ones as healthcare providers and stakeholders begin to recognise the benefits of keeping the population healthy.[2] The rise of chronic diseases in the region, exacerbated by an ageing population and the ongoing pandemic, has accelerated the need for a different approach in healthcare.

In Japan, a series of reforms have been introduced by the government, including the introduction of an Integrated Community Care System.[3] Combining long-term healthcare, housing and livelihood support services, this unified application ensures Japan's elderly have access to continuous quality care in their immediate local communities instead of relying on hospitals.

In Singapore, a "3 Beyonds" strategy was introduced by the Ministry of Health to ensure the quality and affordability of its value-based healthcare solutions extends into the future.[4] Like Japan, Singapore's "beyond hospital to community" initiative was designed so patients are able to receive the appropriate care at home or within their communities, and hence, avoid frequent hospital admissions.

Another facet of this strategy is "beyond quality to value", which aims to increase the quality of care while ensuring value for money. To power this change, Singapore's Agency for Care Effectiveness (ACE) was set up for this specific purpose.[5] For instance, if a new drug costs more but offers better outcomes, ACE will disseminate its findings along with fee recommendations to doctors

"Together, we will work towards shaping clinical guidelines and healthcare policies based on high-quality real-world data."

— Professor Lim Soon Thye, Co-Executive Director of Singapore Translational Cancer Consortium, Deputy Group Chairman Medical Board at SingHealth and Deputy Medical Director (Clinical), National Cancer Centre Singapore

in both private and public sectors.[6] These benchmarks act as countermeasures to help stem escalating healthcare costs.

Banding Together to Fight Cancer

Such efforts are in reaction to the unprecedented convergence of medical knowledge, technology and data science that has the potential to revolutionise patient care.

In February 2021, a public-private partnership between the Singapore Translational Cancer Consortium (STCC), National Cancer Centre Singapore (NCCS), National University Cancer Institute (NCIS) and Roche, was launched which seeks to advance personalised cancer care.

To ensure that screening, enabling medical diagnosis, treatment and even prevention of diseases like cancer can more effectively transform the lives of patients everywhere, the initiative aims to build a clinico-genomic database (CGDB) that combines real-world evidence and clinical insights through data derived from more than 400,000 anonymised patient profiles.

With the establishment of a national precision oncology infrastructure, the hope is that information sharing from comprehensive genomic profiling, to molecular tumour boards and outcomes monitoring will support the application of care that generates improved patient outcomes. "In some cancers, comprehensive molecular profiling may enable the most precise treatment to be tailored based on the genetic profiles of patients' tumours," says Dr Iain Tan, Senior Consultant Medical Oncologist, NCCS.

Ultimately, the collaboration endeavours to improve the standards of care. Professor Lim Soon Thye, Co-Executive Director of STCC, Deputy Group Chairman Medical Board at SingHealth and Deputy Medical

Director (Clinical) at NCCS believes, "Together, we will work towards shaping clinical guidelines and healthcare policies based on high-quality real-world data that addresses the challenges of growing healthcare demands in Singapore."

Focus on Patients, Eliminate Inefficiencies, Enable Medical Diagnosis

For the value-based healthcare concept to flourish, healthcare institutions require unreserved commitment from governments, together with the support of healthcare providers to drive change through system-wide incentives. The end goal should be clear: to humanise the patient experience.

To that end, "make sure that incentives and reimbursement are set up based on the outcomes. This will benefit not only the individual but also the healthcare system," outlines Dr Åkerman. "We should try to move away from volume to value because when you understand what brings value, then you can scale up that value within the ecosystem and get rid of wasteful spending," she concludes.

Can Clinicians Make a Financial Case for

Better Healthcare?

In the face of rising healthcare costs, clinicians are stepping up to improve health and financial outcomes for patients with evidence-based interventions.

The rising cost of healthcare[1] is a topic of global concern. Compounded by factors such as ageing populations and growing demand for care, many countries were grappling with increasing healthcare costs[2] even before the pandemic happened. This has a cripplingly adverse impact on society. The World Bank and World Health Organization (WHO) estimate[3] that hundreds of millions struggle to meet healthcare costs around the world.

WHO argues that countries must offer universal health coverage (UHC)[4] to help individuals receive the care they need without financial hardship. That will take time. In the face of such problems, some clinicians are stepping up and taking matters into their own hands. One way that they are doing so is through evidence-based health interventions.

That's where change-makers like Professor Woo Yin Ling come in.

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"You really need to prioritise what will change the health management for a patient."

— *Professor Woo Yin Ling, ROSE Foundation*

"Knowledge about what tests to order is critical."

— *Professor Marion Saville, Executive Director of VCS Foundation*

Building a Rosier Future

"You really need to prioritise what will change the health management for a patient. When you order a multitude of tests, ask yourself: does this work?" says Professor Woo, who teaches obstetrics and gynaecology at the University of Malaya. The wrong test not only wastes resources, but also adds expenses for patients, she says.

Professor Woo heads Program ROSE[5] (Removing Obstacles to cervical ScrEening), established by ROSE Foundation, a joint venture between the University of Malaya and Australia-based not-for-profit organisation VCS Foundation. Its goal: to eliminate cervical cancer in Malaysia. Despite being a preventable disease,[6] cervical cancer remains one of the top three most common types of cancer[7] among women in the country. This is due to factors ranging from patients' lack of awareness[8] to the poor sensitivity of Pap smears, the default screening method in Malaysia.

Program ROSE's solution is to empower patients by increasing accessibility and providing them with localised solutions. It adopted a novel approach to cervical screening, integrating self-sampling, HPV (Human Papillomavirus) screening and digital health platforms to meet the healthcare needs of local women.

To date, the programme has successfully screened over 10,000 patients in Malaysia.

The journey was not always a rosy one, shares Professor Woo. She cites her personal experience with choosing the right type of screening method. At the start of the programme, Professor Woo was faced with hundreds of different HPV tests in the market. "I didn't know what was useful and what wasn't," she admits. It was only through extensive research and collaboration with partners, including VCS Foundation, that she managed to select the best option.

Yet this approach towards diagnostics helps clinicians. "Healthcare professionals need to have that desire to learn and to provide better care," Professor Woo says. "Prioritising diagnostics for a particular condition is extremely important."

A Path to Eliminate Cervical Cancer

It is this same desire to innovate that drives Professor Marion Saville, Executive Director of VCS Foundation.[9] She played a pivotal role in the roll-out of the COMPASS Trial in Australia, the first clinical trial in the world to test new cervical screening programmes in an HPV-vaccinated population. Data from the trial informs cervical screening in Australia, set to become the first country in the world[10] to eliminate cervical cancer effectively. Already, Australia has transitioned its National Cervical Screening Program[11] from two-yearly Pap smears to more effective five-yearly HPV tests.[12]

"Knowledge about what tests to order is critical," says Professor Saville. For example, in the case of HPV screening, she notes that the duration between tests increased, but the overall cost was still lower than Pap smears, thanks to new advances in technology.

An analysis by Professor Saville's Australian colleague, Professor Karen Canfell and team,[13] found that the annual cost of Pap smears on a vaccinated cohort amounts to AUD192 million, compared to AUD 142 million for HPV screening. The incidence of cervical cancer would also fall by 24 percent with HPV screening.[14]

With the same goal in mind, Professors Saville and Woo work closely together to improve health and society outcomes. "We're motivated by the fact that this is a cancer that affects women in the prime of their life, where they're important to their families and communities," shares Professor Saville.

She adds, "The impact I'd like to see is we not only reduce the incidence of cancer but also reduce the stage at which they're presenting, so they can be effectively treated."

That impact is already visible through Program ROSE. So far, it has detected four incidents of cervical cancer in patients, one of which was in stage one. The early diagnoses enabled clinicians to treat them effectively. "It's these stories that make Program ROSE what we want to champion," Professor Woo says.

The Need to Build Trust

Such positive outcomes beg the question: why aren't more clinicians using HPV testing instead of the age-old Pap smear? Change is always hard, explains Professor Woo, especially for doctors accustomed to offering Pap smears. She likens this to the example of cashless technologies, which received slow uptake at the start. "Trust in something new takes time to establish," she says.

To build trust, clinicians must stay updated on new approaches and assess the evidence available. This enables them to provide the proper care for each patient, Professor Woo adds. "When the clinician is confident, the patient will be confident with the test."

That said, the whole healthcare ecosystem — from policymakers to healthcare providers — must come together to find a cure for rising healthcare costs. In Australia, Prof Saville shares that the government played a vital role in the fight against cervical cancer. "The Australian government has had a long commitment to cervical screening. Our health policy decisions are rooted in the evidence and have been for decades now."

A Mantra for Success

As new technologies and policies emerge, Professor Woo hopes that she will leverage new tools to work towards eliminating other types of cancer. Meanwhile, she is guided by her mantra: "Treat every patient how you want your family member to be treated."

By putting themselves in their patients' shoes, healthcare professionals will better understand what can be done to improve how care is delivered. Then, she says, "The solutions will come easy."

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MYOCARDIAL MONITOR BIOPSY
3D WIREFRAME SCAN

AI-powered Labs,
the Labs of the Future

Rising patient numbers and recurring disease outbreaks are intensifying demand for lab testing.
How will labs tackle tomorrow's needs in a rapidly shifting health landscape?

All eyes are on AI now, as labs powered by machine learning drive drug discovery and diagnostics. Whether AI in healthcare is providing answers that aid clinical decisions or, as seen during COVID-19, facilitating vaccine research trials, diagnostic testing continues to play a critical role in healthcare delivery.

In the case of the Moderna vaccine trials, antibody testing was used to facilitate the quantitative measurement of SARS-CoV-2 antibodies and help to establish a correlation between vaccine-induced protection and levels of anti-receptor binding domain (RBD) antibodies.[1]

Any potential vaccine for SARS-CoV-2 would work (amongst other mechanisms)

by triggering the immune response to develop neutralising antibodies in the person receiving the vaccine. Meanwhile, testing would baseline and assess any change in antibody levels.

Rise of the AI-powered Lab

It is not just in the fight against new diseases that progress has been made. Labs have also helped to push scientific progress forward by decades in areas such as cancer.

By identifying and developing innovative predictive diagnostics to target those patients who are more likely to respond to specific therapies, testing enables the early detection and treatment of patients, thus significantly improving outcomes.

But how can health systems provide quality care when the pool of cancer patients is exponentially higher than the number of healthcare professionals? The solution — applying AI to diagnostics.

Doing this can help increase the number of cases reviewed by pathologists, improve accuracy by reducing human error, and enable personalised treatment plans. Ergo, such an approach can save even more lives — and is. Today, automated digital pathology algorithms use AI to support pathologists in making fast and accurate patient diagnoses in breast cancer.

Amplification in the HER2 gene, which occurs in as many as 20 percent[2] of the nearly 2.3 million cases of breast cancer

THE ALGORITHM WILL SEE YOU NOW: IMPROVING PATIENT CARE WITH AI-DRIVEN LABS

For many lab professionals, artificial intelligence (AI) is becoming a vital ally. By enabling quicker and more accurate diagnosis, AI can dramatically augment care.
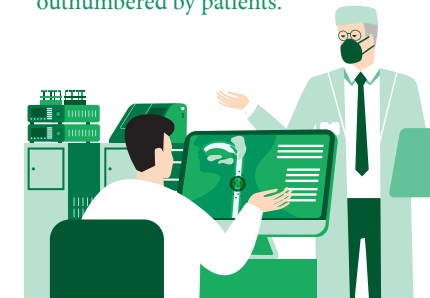
Manpower Challenges Impact Cancer Care:

Healthcare professionals are being outnumbered by patients.

- For example, globally, new cancer cases are expected to rise to

29.5 million[1] by 2040.

- As a result, the workload of pathologists have risen by some

42%[2]

Additionally, long-term disruptions brought on by COVID-19 could stretch already limited resources.

AI Delivers Speed and Accuracy:

Deep learning artificial neural networks have been developed that can diagnose entire batches of patient images. In one study, 1,118 oesophageal cancer cases were accurately analysed in

27 seconds.[3]

Early Detection in Heart Diseases Remains a Concern:

In some severe diseases, such as types of heart condition, symptoms do not show until later stages, when patient survivability is compromised.

- ### Multi-tasking Machine Learning Detects Risks Earlier:
Machine learning algorithms in heart disease[4] can better monitor and detect potentially life-threatening episodes at earlier, more treatable phases.

A diagnostic method which combines echocardiography videos, image processing and AI can achieve

99.38% sensitivity and 99.63% specificity[5]

in detecting mitral regurgitation (MR), a common heart disease. Symptoms of MR often do not show till the end stage.

The Added Value[6] of AI in the Lab

- Avoid unnecessary tests (and therefore costs)
- Improve insights through machine reading of medical lab records
- Enhance quality of care, such as automated follow-ups to patients
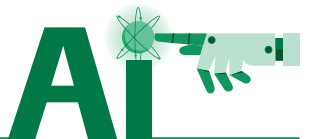
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diagnosed globally[3] each year, is responsible for aggressive growth in some patients. Identifying this amplification is important in determining which patients may benefit from targeted treatment. Using AI-based image analysis algorithms can support pathologists in improving efficiency and precision.

This also holds true during a lockdown when remote care is the only option. In

India, Dr Sangeeta Desai, Professor and Head of the Department of Pathology at Tata Memorial Centre, says she and her team quickly shifted to a remote sign-out approach during the ongoing pandemic to allow them to analyse the slides and make diagnoses from home. They reported nearly 550 cancer cases this way, providing patient care that would not have been possible without digital pathology.

That's not all. As Professor Yi Zhang, Director of the Clinical Laboratory at Qilu Hospital in Shandong University, China believes, clinical lab data can be aggregated and analysed to improve patient care and healthcare system management.

Professor Zhang's lab, which is affiliated with one of China's top teaching hospitals, makes considerable effort to clean and classify such

"We should be rational about AI instead of relying too much on it."

— Professor Yi Zhang, Director of the Clinical Laboratory at Qilu Hospital in Shandong University, China

data in order to facilitate data mining and artificial intelligence applications.

"The integrity, coherence, integration of these data, as well as the scientific and structured preservation of data, are very important for the subsequent data mining," he says. By carefully managing clinical lab data and mining them for insights, lab professionals can develop new tools for disease prediction, preventative care, precision medicine, clinical decision support, clinical research, utilisation management and more.

Introducing AI in Lab Testing

It is more pivotal than ever to accelerate AI adoption by lab professionals or, at the very least, begin to augment their work with AI.

That AI is complex, expensive and often requires significant changes to operational processes is a given. More than that, it

demands an ultra-specialised talent pool that currently stands at just 477,956 worldwide.[4]

However, this does not mean that labs cannot take small steps, or partially implement AI, to pave the way for large-scale adoption down the road. For instance, labs can assuage fears of being replaced by AI by illustrating how it evolves existing roles, and crucially, makes life easier for its human "co-workers".

But it is not a silver bullet for all healthcare challenges. As Professor Zhang says, "We should be rational about AI instead of relying too much on it."

Ready for the Future of AI in Healthcare

What has been discussed as a long overdue yet much ignored set of needs in healthcare delivery — connectivity, integration and automation in the lab — is finally receiving due recognition. And the potential benefits

to healthcare systems are enormous. A consolidated laboratory system offering a broader range of tests can generate a wealth of diagnostic data.

With fewer resources required for manual operations (supported by AI where necessary), laboratory staff can be freed to perform more skilled roles, be better integrated within multidisciplinary teams and be prepared for a future where disease outbreaks and health emergencies may increase in frequency.

By future-proofing care delivery, health systems will be better equipped to meet the emerging needs of individual patients. Harnessing AI to produce tangible insights will allow doctors to provide the ever-growing number of patients with holistic, accurate and precise diagnoses, as well as prevention and treatment solutions — all at a faster pace.

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