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Ja:gram

INFECTIOUS DISEASES EDITION

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Note from the Editor-in-Chief



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Dear Readers

It would be impossible to begin this note without mention of COVID-19. We are all living with the reality of life in a new normal. That is why we were so keen to focus on infectious diseases in this issue.

This isn't the first or last pandemic that we will live through. While it has certainly been devastating, as an expert says in his interview with **Dia:gram**, "We have to learn to live with this virus, from this point on."

What does the threat of existing and new infectious diseases mean for our region in a post-COVID world? Find out in our latest edition.

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Fighting Infectious Diseases in a **Post-COVID** World

When an earthquake strikes, it shakes up everything. Then come equally violent aftershocks, exposing shaky foundations long after the initial event. In many ways, the COVID-19 pandemic has been like that earthquake — unearthing deep flaws and weakening the very foundation on which healthcare has been built.

Much like earthquake-resistant infrastructure and smart engineering can counteract future seismic shifts, the time has come to redesign the current healthcare ecosystem. Fundamental to this is changing our approach to healthcare from "sick" care to "well" care. Funding healthcare in a way that incentivises prevention, screening and better disease management will allow us to strengthen our collective response to disease outbreaks before they reach epidemic levels.

What Will it Take for Healthcare to Evolve?

Based on the United Nations Conference on Trade and Development's estimates, the global economic slowdown caused by the coronavirus outbreak is likely to cost at least USD 1 trillion.¹ While the direct and most visible impact of this will be in reduced healthcare spending by governments around the world, the consequences of a combined health pandemic and global recession will be catastrophic for developing countries, (many in Asia) which are already struggling with basic healthcare delivery.



In the last three decades alone, there have been at least 30 new infectious diseases, *many of which* have no known treatments, cures or vaccines.

The global Epidemic Preparedness Index (EPI) published in the British Medical Journal (BMJ) Global Health notes that Western Asia and Southeast Asia remain vulnerable to disease emergence, particularly from animal transmissions.² As an economic powerhouse, Asia Pacific has seen exponential growth and development, but the rapid urbanisation could come at a high human cost as the region's risk of infectious diseases continues to rise.3

The flip side of this economic growth has been the long-term repercussions of the growing number of epidemics loss of productivity as a result of deaths and chronic debilitating illnesses, reduced economic migration and decreased foreign investment.

The Cost of Ignoring Infectious Diseases

The absence of a direct and obvious link between disease control and societal health can make it difficult to sustain public health policies and therefore, funding. The cost versus benefit planning methodology in the context of healthcare disregards the knock-on effect of poor preparedness - a decision that comes at a heavy price.

In the last three decades alone, there have been at least 30 new infectious diseases, many of which have no known treatments, cures or vaccines.4 Yet there continues to be a greater focus on tackling non-communicable diseases (NCDs), in some cases by deprioritising infectious disease management.

Tuberculosis (TB), for instance, has been responsible for the death of more people than any other infectious disease; over a billion deaths in the last 200 years.⁵ Without a substantial increase in investments for TB prevention, diagnosis, care and treatment — projected at USD 25 billion until 2030 against the 2017 expenditure of USD 8.3 billion - member states of the World Health Organization (WHO) Southeast Asia Region (SEAR), which have the highest global TB burden, will find it difficult to make significant progress.6

Although some infectious diseases like smallpox and polio have been successfully eradicated, many represent an unending global health challenge. The burden of infectious diseases can stymie societal health, reversing decades of progress made in the management of diseases. A new Economist Intelligence Unit report suggests the pandemic has severely affected cancer care including screening, diagnosis and treatment.7 However, such outbreaks also take a toll on the management of other infectious diseases, and on already vulnerable populations.

THE OUTBREAK OUTLOOK, THEN AND NOW

1996 "We are standing on the brink of a global crisis in infectious diseases. No country is safe from them. No country can any longer afford to ignore their threat." — Dr Hiroshi Nakajima, then-Director-General of WHO^{*}

^{*}World Health Organization. (1996). Infectious diseases kill over 17 million people a year: WHO warns of global crisis. Retrieved from https://www.who.int/whr/1996/media_centre/press_release



Disruptions to healthcare delivery in the case of HIV, for instance, has slowed down prevention and testing services from reaching the groups that most need them, according to the WHO.8

Early lessons from COVID-19 show that the absence of a long-term view can hamstring preparedness, create inefficiencies and result in needless deaths.

Health systems in Asia Pacific must urgently address this, or risk history repeating itself.

The Building Blocks of **Healthcare Resilience**

To complement a strong surveillance and response strategy, there is a need to reframe national health policies to incite fast decision-making and decisive action. The speed with which countries could deploy mass testing or change testing strategies to suit the rapidly evolving situation has been a real test of their ability to control widespread transmission during COVID-19. Without the appropriate laboratory infrastructure and resources to support timely and accurate results, this would not have been possible.

The next decade will see the convergence of several forces within healthcare that will place diagnostics at the core of a new *health ecosystem.*

The Asia Pacific Medical Technology Association (APACMed) has outlined mechanisms to promote robust policy frameworks when it comes to diagnostics.9 These include emergency approval pathways that speed up access to new test kits; creating a separate but parallel "fast track" that allows regulatory resources to be directed to quickly review and approve test kits as they evolve; and harnessing overseas reference models and authorisations like the WHO Emergency Use Listing procedure, so that fewer resources are wasted through duplication of efforts. While COVID-19 may be the driver for such changes, the benefits of such a framework could well outlast the current pandemic and help battle any future disease outbreaks.

However, it requires considerable political will and sustained investments, particularly in technology. Digitalisation, big data and artificial intelligence are becoming increasingly crucial to healthcare delivery.10

At its core, digital health represents muchneeded linkage between data science and healthcare, comprehensively connecting the dots for better, more informed health decisions – providing early warning for infectious disease outbreaks, and real-time information to inform disease control and elimination programmes that can improve

diagnosis and patient management. For digital innovation to truly transform health systems though, policymakers must smooth the path and with it, leverage technology that can address some of the gaps created by an existing laboratory workforce shortage.11

Despite the falling number of laboratory staff, millions of COVID-19 tests are being performed around the world. To manage the pandemic-led increase in demand, and jump in routine testing that will likely happen post-pandemic, laboratories need solutions that enable greater efficiency and ensure they are well-prepared to handle future outbreaks.

Automated and fully integrated core labs can deliver high-quality and accurate results. With the focus of regulatory agencies shifting to data veracity and traceability, lab automation can deliver on this promise.

There is no doubt that finding a solution to the laboratory workforce shortage is a complex task but taking corrective action can ensure countries have enough trained lab professionals to meet future demands.

Every country is learning that diagnostics, which until recently has been a sector often underfunded¹² or hampered by inflexible regulations and



THE OUTBREAK OUTLOOK, THEN AND NOW

2020

"Public health is the foundation of social, economic and political stability. That means investing in populationbased services for preventing, detecting and responding to disease." - Dr Tedros Adhanom Ghebreyesus, **Director-General of WHO***

lack of co-ordination, is a crucial first step to fight infectious diseases before they spiral out of control. However, stumbling blocks remain, and addressing these must become a national priority. With diagnostic tests requiring dozens of components, misguided planning can cause testing bottlenecks and, as we saw with COVID-19, widespread shortages.

Fighting on all Fronts

The current pandemic has exposed just how vulnerable health systems are, but it has also given us a realworld example of collaborative action. The world has successfully eradicated infectious diseases in the past, and we can do the same again with a sustainable approach to public

health policies. As more countries and stakeholders recognise this, the region's chances of fighting infectious disease will improve dramatically.

Is Asia truly prepared for the next outbreak? That will depend on the lessons we learn today —whether or not we act on them will be the true test.

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The Next Pandemic is Coming: Is Asia Prepared?

While the world waits in hope for a cure for COVID-19, the science community is already looking ahead to the next pandemic.

Back in 2018, a World Health Organization (WHO) consultative panel noted the inevitability of future pandemics, drawing up a list of emerging diseases for which there was no known vaccine or cure. The list included SARS (Severe Acute Respiratory Syndrome), MERS-CoV (Middle East Respiratory Syndrome Coronavirus), Nipah and henipaviral diseases, Zika disease and an as yet unknown "Disease X."¹ These findings have been reinforced in recent times², as normal life remains eclipsed by the COVID-19 pandemic.

National Initiatives: Learning from the Past

Each pandemic has distinctive challenges, says Professor Tikki Pangestu, Visiting Professor at Yong Loo Lin School of Medicine, National University of Singapore and former Director of Research Policy at the WHO, but lessons can be learned from all. "The weaknesses we're seeing in our health systems have worsened because of COVID-19, but they are not new. SARS and bird flu revealed similar gaps in care delivery whether it's the need for rapid testing, measures to protect frontline healthcare workers or setting up clinical facilities to manage severe cases." Singapore, with its Surveillance and Epidemiology Programme for vectorborne disease³ has shown how a multi-pronged framework grounded in diagnostics, and including ecology risk assessments, can enable early detection of multiple infectious outbreaks. Data from this framework allows the country to forecast future infection trends.

Similarly, Hepatitis Eradication Programmes launched in Thailand, Bangladesh and Indonesia highlight the importance of a national strategy in addressing the infectious disease burden. While these countries have seen some early success, ensuring the burden remains low requires dedicated effort, as experts advise conducting regular serosurvey testing, and a comprehensive primary healthcare structure.⁴

The capacity and capabilities of health systems play a central role in whether outbreaks are identified and contained before they spread. Thailand's success in controlling Hepatitis B, for example, can be credited to its strong primary healthcare (PHC) system and extensive network of health professionals. As the country rapidly expanded its primary health infrastructure, it also introduced programmes to ensure there are enough healthcare workers in rural communities.⁷

"The weaknesses we're seeing in our health systems have worsened because of COVID-19, but they are not new."

Professor Tikki Pangestu
(pictured left), former Director
of Research Policy at the World
Health Organization

This is hard to achieve without political will.

In 2019, the Pakistan government announced its ambitious hepatitis eradication plans. The country has one of the highest hepatitis burdens in the world with nearly 5 million people infected with Hepatitis B, and 10 million by Hepatitis C, each year.⁸

The government hopes to counter the inadequate prevention, testing and treatment resources by increasing awareness and screening efforts. An analysis published in The Lancet pegs the initial cost of funding such an Systemic vulnerabilities and flawed planning have hindered region-wide progress against infectious diseases.



approach at USD 8 billion but estimates a considerable reduction to USD 3.9 billion following cost savings from early diagnosis and treatment.9

A New Model of

Regional Cooperation Infectious disease management requires all countries to have an effective healthcare system; otherwise, weaknesses in one country can easily create a ripple effect in others. The vastly different approaches to the COVID-19 crisis have highlighted the need for a decisive and unified regional — and global - response. By working together, stakeholders can foster policy agility, minimise supply disruptions and avoid a severe economic downturn.10

When dealing with an unknown disease, cross-border collaboration within the scientific community is equally paramount to the development of a strong response backed by clinical evidence, giving every country a fighting chance.

Dr Rob Grenfell, Director of Health and Biosecurity at Australia's Commonwealth Scientific and Industrial Research Organisation (CSIRO), says countries with lower mortality rates were better at sharing details on early surveillance, testing, contact tracing and quarantine.

While PCR (polymerase chain reaction) tests are "the gold standard" in molecular diagnostics, without adequate lab infrastructure, or in remote patient settings, it may not be an appropriate solution. Many developing countries have turned their attention to point-ofcare (POC) immunodiagnostic tests that can be conducted even in decentralised healthcare settings, helping countries trace and treat COVID-19 cases.11

EVOLVING HEALTH POLICY



In response to the COVID-19 outbreak, India's Ayushman Bharat healthcare scheme, which covers

500 million people,

was extended to reimburse the cost of COVID-19 testing in private labs.*

International Labour Organization, 2020 Social protection responses to COVID-19 in Asia and the Pacific: The story so far

As the novel coronavirus evolves, different solutions will be needed. "It really depends on what problem the health system is trying to address. This is where scientific evidence, the sharing of data becomes an important piece of that puzzle," says Dr Grenfell.

"Coronavirus is here to stay. We will have this infection from this point onwards in humanity and we have to learn to deal with it, starting now," he adds.

A Matter of When. Not If

For too long, systemic vulnerabilities and flawed planning have hindered regionwide progress against infectious diseases. A shaky care delivery system has continued under considerable strain, and despite the many obstacles it faces.

As a paper in the British Medical Journal (BMJ) notes, "Policy

reviews conducted in the aftermath of past epidemics and pandemics have consistently emphasised the importance of strengthening national-level preparedness for public health emergencies, especially to face the threat of new diseases or ones with no known treatments."12

It is not hard to argue that any country was fully prepared for the magnitude of the current pandemic. And, we may not be for the next one unless we are willing to challenge the status quo and urgently prioritise the implementation of lessons from disease outbreaks. This is much needed and long overdue.

We can rebuild a resilient and future-proof health ecosystem, but it requires a complete overhaul of current structures to reduce complexities and remove barriers.

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HOW PANDEMIC MEASURES NOW **ARM COUNTRIES** FOR THE FUTURE



Dr Faisal Sultan, Pakistan's Special Assistant to the Prime Minister on National Health Services, Regulation and Coordination, shares learnings from his country's COVID-19 response.

How might Pakistan's response now help mitigate future pandemics?

A crisis is "good" or "bad" depending on the lessons you learn from it. COVID-19, just like SARS and other epidemics in the past, has once again emphasised the vital role of our public health system. When an infectious disease impacts lowand mid-income countries where you have a persistent level of other infectious diseases like hepatitis, TB, polio and malaria, it not only impacts health outcomes, but also negatively influences economic outcomes.

We have implemented several measures to strengthen our laboratories as well as our surveillance and tracing capacity. This will not only serve us during the pandemic but also help us to combat other diseases. Furthermore, our PCR testing capabilities have significantly grown, with over 100 new labs.

WARD

To what extent is effective epidemic prevention down to actions like aligning stakeholders?

One of the hardest things to do during a crisis is to ensure proper governance and clear-cut communication lines. We have been working on the basis of continual learning, with daily improvements in communication, governance and implementation of interventions. It's a methodology that is sure to bolster how we tackle future outbreaks.

What part does testing play in creating an integrated epidemic prevention response?

The role of diagnostics is a key pillar in Pakistan's strategy. Without that, you cannot prevent, eliminate or mitigate the pandemic. Quite simply, if you don't know where the outbreak is, you can't tackle it.

Building an Integrated Epidemic Prevention and **Control Strategy**

A clear local strategy and unified global approach like the WHO Cancer Control Strategy has helped many countries implement cancer prevent and control programmes. How can this be applied in the space of infectious diseases in Asia Pacific?

Since 2009, the World Health Organization (WHO) has designated five disease outbreaks — excluding the current COVID-19 pandemic - as a "public health emergency of international concern": Ebola (twice),12 swine flu or influenza A (H1N1),³ polio virus4 and Zika.5

Public health experts are understandably concerned about the frequency and



velocity of these outbreaks. There are close to 200 outbreaks recorded globally each year.6

While healthcare performance indicators such as the cost of drugs and diagnostic tests, number of hospital beds or the number of patients treated have been used in the past,⁷ public health experts say updated parameters that consider healthcare sustainability should be used to measure the effectiveness of policies.



Chris Hardesty is part of KPMG's Global Healthcare & Life Sciences Centre for Excellence

Chris Hardesty, who is part of KPMG's Global Healthcare & Life Sciences Centre of Excellence, concurs. "Health investments by governments in Asia Pacific solely as a proportion of gross domestic product (GDP) can appear imbalanced when compared to the West or other developed nations. But the goal should be to improve the quality-cost equation by creating greater efficiency within the allocated funds and a heightened focus on individual accountability."

"Take Singapore for example, which spends around 5 percent of its GDP on healthcare (half the recommended target) yet achieves life expectancy and health outcomes on par with other developed countries, in part due to creative concepts such as a nationalised Health Savings Account (HSA)," he adds.

Recent experiences have certainly heightened awareness among government leaders about the strengths and weakness of their healthcare systems. More importantly, it has emphasised the importance of government commitment to systematically strengthening health system capacity and parallel progress towards universal health coverage and global health security.⁸ These are core elements to ensure pandemic preparedness and achieving targets outlined in the United Nations' Sustainable Development Goals (SDGs).

A robust preparedness framework and response capacity has proven to be a key aspect of informed decision-making in managing COVID-19. Professor Tikki Pangestu, former Director of the WHO's Research Policy, says, "The ideal epidemic prevention and control strategy should integrate multiple components to support the deployment of appropriate resources across the different stages of a disease outbreak."

Ramping up efforts while discontinuing chronic care services or suspending surgeries can negatively impact societal health. This is where early warning signs are critical. Specifically, he says that the core of any good infectious disease management strategy requires a strong disease surveillance mechanism. Diagnostics and testing are the starting point for disease monitoring and tracking and in guiding appropriate public health measures to control outbreaks.

Fundamental to the development of such a strategy is a well-balanced approach that focuses on three key elements:

1. Healthcare Financing

Prioritising public health spending has been shown to be a major contributor to economic growth.9 "Evolving the system into a truly fortuitous collaboration that improves population health, at a more cost-effective base, while building an industry around it has long-term economic benefits," says Hardesty.

In a paper published in The Organisation for Economic Co-operation and Development (OECD) Journal: Economic Studies, the authors predicted that, if no additional measures are taken, the total cost of healthcare across OECD countries will almost double by 2050, reaching, on



average, approximately 13 percent of GDP.10 This would place significant strain not only on health systems but also on social and economic sustainability, and could further widen health inequalities.

"Despite the 'health-for-wealth' mantra that has been touted for many years, the intertwine between health and economy is now very clear; countries that enable wider healthcare access will see dividends through a more productive population, even if it means shifting the way we live and work," says Hardesty.

2. Universal Health Coverage

In advocating Universal Health Coverage (UHC) — affordable healthcare for all the WHO points out that UHC doesn't just save lives. It can offer protection during economic upheavals as recent instances have starkly reminded us.¹¹ The rise of the gig economy has created a workforce that does not have access to paid sick leave or health insurance, meaning more are forced to work even when they should be staying home.

This not only creates a greater risk in the community, but also widens the wealth gap. Meanwhile, access to health services has been shown to improve health indicators and reduce poverty.11 "Equitable distribution can ensure that investment in local primary healthcare services, prevention and health promotion are not overlooked in favour of tertiary hospital care and urban centres alone," says Professor Pangestu.

Hardesty believes every country should develop a UHC model that works within its local environment, stressing that developing countries need not simply try to play catch-up with the UHCs of developed countries, which are based on models from a century ago. "Instead they can develop their own next-generation version for the 21st century. I feel encouraged by health system designs going on in places like India, China, Vietnam and Malaysia,

Prevention Pre-emptive measures through health promotio and behaviour change

> Control Address infectious diseases before they become severe ou

Stages of Infectious Disease Transmission

- contained Epidemic - spreads
- large area Pandemic – spread across countries or continents¹



A Framework for Infectious Disease Management



- tments in
- Health System Resilience Performance vis-à-vis UN
- inable Development Goal Efficient resource allocation
- and capital investment
- ements in universal health access
- Policy Agility Speed and effectiveness Creation of emergency
- equilatory mechanisms



among others, in embracing public-privatepartnership ideologies," he says.

3. Developing the Right Infrastructure to Support Healthcare of the Future

In an outbreak scenario, digital tools are no longer a nice-to-have, but a must-have to bridge gaps in care delivery. Nationallevel data collection presents a macro view on which larger strategic decisions about disease control can be made. This not only saves costs, but saves lives. As a 2019 WHO paper notes, "within fragile developing

health systems" in particular "the availability of updated data is essential".12

In this vein, COVID-19 has caused an uptick in digital health technology use. As the Australian Digital Health Agency notes, "Two accelerated digital health features telehealth and electronic prescriptions were always planned to be part of our health system. COVID-19 gave it a kick-start."13

While COVID-19 has hastened this transition, policymakers across the

region have their work cut out for them - enabling data interoperability within a secure digital ecosystem.

Crises often breed innovation. As the world looks to overcome urgent problems, solutions — old and new — have manifested in different ways. It is such innovation that will help the world, including Asia Pacific, develop and implement an effective, integrated strategy to prevent and control epidemic diseases, ultimately leading to better healthcare for all.

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When Outbreaks Strike, **How Does Clinical Practice Evolve?**

In a public health emergency, healthcare professionals have to ensure the continuity of care while managing the sudden rise in cases and evolving clinical guidelines.

As the world has seen, epidemic threats can have a devastating impact on clinical practice, besides placing unprecedented strain on healthcare personnel and resources.

How Clinical Practice is **Evolving to Cope with** Infectious Disease Outbreaks

In 2003, the SARS (Severe Acute Respiratory Syndrome) outbreak was a challenge the world was largely unprepared for. Health services in many disciplines were severely disrupted, while coping with staff shortages quickly became a major obstacle for healthcare providers.¹

In Singapore, the nation's strategy for containing the SARS outbreak was to centralise treatment of suspect cases in a single healthcare facility. Non-SARS patients were declined admission to reduce the risk of infection in the hospital environment.² Six years later, the Ministry of Home Affairs published its pandemic readiness and response plan, Preparing for a Human Influenza Pandemic in Singapore, utilising a similar model to prepare for potential outbreaks, such as H5N1 (avian influenza), which threatened the region. All suspected and confirmed cases, as outlined in the Ministry's plan, were to be centrally managed at designated healthcare facilities.³

Such a streamlined structure may not be feasible in a developing nation. The Philippines has been grappling with consecutive outbreaks of measles, dengue



and polio for several years; learning to adapt and evolve fundamental practices has been key to managing patient care.

As Dr Anna Lisa Ong-Lim, chief of Infectious and Tropical Disease of the paediatrics department at the University of the Philippines explains: "We had to adjust the way we delivered healthcare, the way we set up our clinics and even our hospital wards." It's a change that hospitals across the world have struggled with.4 "While patient care teams prepare

Clinical Conversation

for such scenarios, the inherent surprise element of an outbreak means you can never be fully equipped."

Even common activities like bedside visits and scheduling require overnight change. "We have had to prioritise cases, reschedule surgeries. These are tough decisions to make - how can anyone decide which patient is more important than the other?"

Healthcare professionals swiftly began using digital tools such as video consultations

to evaluate patients, and clustering care activities such as giving medication. While digital tools have been able to bridge short-term challenges, inequities remain. "Telehealth for outpatient calls is a mode many healthcare providers are switching to. But patients in poorer communities may not have the necessary mobile connectivity to support this."

The Danger of Disruptions in Care

Surges in cases during a pandemic create a knock-on effect. COVID-19 saw many procedures deemed as less urgent, such as annual physicals, deferred.⁵ This could mean that many millions of serious health concerns, such as diabetes or cancer, are not caught. As Dr Ong-Lim notes,



tests available. Doctors were treating

To avoid such a scenario, physicians, epidemiologists and labs must work closely together to prevent the slowdown of care.8

Challenged by the unusually high number of cases, asymptomatic patients, sudden outbreaks of unknown diseases all while dealing with routine or chronic conditions requires a strong support

government advisories. Otherwise, clinical practitioners, desperate for information, can feel unsure of how to treat and triage patients in the most effective manner.9

To this end, medical associations such as the Indonesian Society of Clinical Pathology and Laboratory Medicine have applied new measures in their clinical guidelines to improve success rates in diagnostic screenings.

Some of these guidelines are evolving rapidly. "At the beginning of the pandemic, one of our protocols was to use antibody and PCR tests to screen the patient. Then we revised it such that the PCR test plays a more important



disruption in vaccination is another ticking time bomb, with swathes of children not being immunised. "Once communities reopen, and children come together again, they are exposed to viruses and are especially susceptible. It's a disaster waiting to happen," she says. The coming decades may thus see a rise in vaccine-preventable diseases that will increase pressures on the health system. One study published in European Respiratory Journal predicts that between 2020 and 2024, there will be more than 200,000 extra tuberculosis deaths in China, India and South Africa due to the pandemic's health service disruptions.6

The Role of Testing in Patient Management

A lack of effective diagnostics is a major obstacle. During the early weeks of the SARS outbreak, there were no diagnostic

"The role of diagnostics is key in disease management, from screening to monitoring."

- Professor Aryati, Chairman of the Indonesian Society of *Clinical Pathology and Laboratory Medicine*

system. "Diagnostic tests give clinicians crucial information on which they can make informed decisions," says Professor Aryati, Chairman of the Indonesian Society of Clinical Pathology and Laboratory Medicine.

As an outbreak evolves along with our knowledge of pathogens, so should the way diagnostics is used. "For example, the design of antibody, antigen and PCR testing should combine the conserved and mutated regions of the disease. This combination of tests is needed due to the limitation of each method's sensitivity," she says.

Changes in Clinical and **Testing Guidelines**

These specific evolutions in technique must be backed up by clear, centralised guidance from medical societies and

role in the screening process. Now, we are considering the antigen test in our guidelines as well," Professor Aryati explains. Similarly, while some countries urge everyone with mild flu-like symptoms to visit a health centre for COVID-19 testing,¹⁰ others only suggest that course if symptoms and high fever persist for several days.¹¹ But as winter flu season begins, guidelines may change, suggesting more people should be tested to avoid what Dr Richard Pebody of the World Health Organization describes as a "double epidemic" of influenza and COVID-19.12

Even surgical guidelines are changing, to evolve preoperative screenings for patients who require high-risk surgery. And, here again, clinicians must fold testing into their practice. "For preoperative services, we have only just started doing elective procedures.



Of course, there is a need to establish that these patients are not incubating COVID-19 or asymptomatic positive so they don't endanger other patients or staff in the hospital," adds Dr Ong-Lim.

While the scientific community has made significant progress in understanding this disease, and refining strategies to combat it, ensuring the continuity of care even in

the midst of public crises of such a global scale can alleviate the burden on public health systems in the short and long term.

As the pandemic evolves, healthcare professionals will find themselves facing new challenges. However, the fundamental nature of their work continuing to deliver high-quality care to all patients - remains.

LESSONS ON EVOLVING CLINICAL PRACTICE

Dr Anna Lisa Ong-Lim shares how the recent pandemic has shaped healthcare delivery in the Philippines.

On Making the Most of Minimal Resources

"Being designated as one of the first COVID-19 referral centres in the country was an additional challenge. Our colleagues who dealt with adult patients were trying to set up their own system, and we in paediatrics had to do the same thing. Despite a lack of resources, we managed to set up an additional 12-bed isolation facility dedicated to children in the hospital. We also reconfigured our manpower so that we would be able to fill in our staff while making sure they were protected from this disease as well."

On the Importance of **Triaging Patients Early**

"I think this crisis has highlighted the need for better preventive health services. For the coronavirus, we know that most cases are mild, with the moderate to severe patients comprising about 15 to 20 percent of the cases. You are dealing with 80 percent who don't require hospital care, but they need to be identified, isolated or quarantined. If we have a system that ensures they receive care at the earliest point, then it is possible they stabilise, and don't progress to the severe stages that would require them to seek facility care."

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Infectious Disease Outbreaks: How Have They Affected Clinical Practice?

COVID-19 is not the first outbreak to cause procedural disruptions in Asia Pacific.

2020

2015

2003

Outbreaks Sand their Impact



2003 IONG KO SARS: Impact on **Diagnosis Strategy**

After identifying the causal agent for SARS, centralised laboratories were set up to provide rapid diagnostic services for suspect cases. Serologic testing, reverse transcription-polymerase chain reaction (RT-PCR) and virus isolation were the main diagnostic methods used to guide patient management and support clinicians with accurate testing.1



CHINA COVID-19: Impact on **Cancer Treatments**

Most radiotherapies have stopped due to the pandemic. Especially for cancer patients whose treatments cannot be exempted or delayed, experts recommend the use of shorter radiation schedules with a larger dose per treatment to reduce the frequency of visits. Testing is to be carried out for all patients with COVID-19 symptoms so that physicians can provide the most effective treatment.3



2015 SOUTH KOREA MERS: Impact on

Surgical Procedures

In a tertiary care hospital in Seoul, two operating rooms were converted from positive-pressure to negativepressure environments to conduct surgical procedures on MERS-related patients. Patients exposed to MERS were tested twice preoperatively and procedures for MERS-related patients were performed at the end of the day where possible, ensuring continuity of care.²

COVID-19 AND MEDICAL GUIDELINES

New Testing Guidelines to Include Younger Patients Doctors in Singapore are to conduct COVID-19 tests on patients aged 13 and above who are diagnosed with acute respiratory infection (ARI). This new clinical requirement was mandated by Singapore's Ministry of Health in June 2020. Prior regulations only required testing of patients aged 45 and above with ARI.⁴

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HIV, Hepatitis and Tuberculosis: **Turning Back the Clock** on Decades of Progress

Treatable diseases are still causing huge numbers of deaths in developing countries. We examine why health systems are failing to counter the existing burden and what can be done to implement effective strategies for diagnosis.

Until recently, the world seemed to be making progress against some of the most persistent infectious diseases. In 2019, 59 percent fewer people died from HIVrelated causes as compared to 2004, and 37 percent fewer than in 2010.¹ However, that progress now appears to be stalling.

Only three countries in Asia Pacific -Australia, Cambodia and Thailand - are on track to achieve the United Nations (UN) '90-90-90' target for HIV in 2020.2

Other diseases are adding to the current burden. According to the World Health

Organization (WHO), 1.4 million people died from tuberculosis (TB) globally in 2019 (208,000 of whom also had HIV).³ India had the highest number followed by China and Indonesia.³ Meanwhile, Hepatitis B (HBV) is responsible for more than 800,000 deaths globally4 every year. According to WHO's

When the system fails to support testing the knockon effect is clear: more people stay unaware of their HIV status.

2016 estimates, some 3.2 percent of the global population is infected with chronic HBV, and almost a third live in China.⁵ In all these cases, ensuring more people are diagnosed can stop the spread.

A Domino Effect of COVID-19 on Infectious Disease Management

The current pandemic has put pressure on health services throughout the world. In particular, it has magnified and highlighted existing problems in developing countries, where poor medical infrastructures and insufficient medical staff may lead to inadequate screening.

Despite the need to modernise, many countries are failing to implement the necessary policies to put in place adequate financing, not least for diagnostics. When the system fails to support testing the knock-on effect is clear: more people stay unaware of their HIV status.

An opt-out approach to diagnosis is an approach that has been tested in certain countries with successful results, uncovering swathes of people who would otherwise have gone undiagnosed.6 Such an approach could fold in other diseases, thereby boosting detection numbers for TB and hepatitis allowing for efficient clinical decision-making and patient care, especially if diagnosed at earlier stages of their illness.6 With an effective testing and follow-up treatment plans in place, such programmes could reduce the rate of transmission of these diseases in the community.



There are good reasons to synthesise the fight against these three diseases into one. Failure to offer a holistic approach to healthcare, including early screening, can lead to the late detection of comorbidities. This kick-starts another chain reaction. A compromised immunity from prior infections leads to more patients with comorbidities, who then need complex clinical management.7 This further exacerbates the pressure on healthcare resources. HIV, HBV and TB patients can also develop antimicrobial resistance (AMR), making them harder and costlier to treat.7 The more you can open access to testing, the less chance there is of people developing multiple infections.

There is another way patient access can be supported — innovation in test kits. For example, plasma separation technology, which protects samples even in heat and humidity, ensures that samples can be transported from rural areas to reliable testing labs many miles away. Similarly,

techniques such as Dried Blood Sampling diagnostics enable infants to be HIV tested in a non-invasive manner and eliminate the need for sample refrigeration. Smoothening the process of infant testing is key, as early diagnosis means they can receive care before symptoms develop. Advancements like this are just the tip of the iceberg, but for progress to continue, so must innovation. Continual improvements that make testing easier and cheaper will help boost the number of people given a new lease of life.

Early Testing is Key. What Stands in the Way? It is easier to treat a patient for one condition before their weakened immune system makes them vulnerable to further disease - but first they need to be tested. Nine percent of HIV-assisted TB cases in the world are found in India, where it causes 11,000 deaths each year.8 About 10 percent of TB patients in India die due to the lack of access to adequate diagnostic

and treatment facilities.9 While developing infrastructure to fill these gaps in healthcare would cost an estimated USD 290 million, this is only a fraction of the cost (USD 32 billion) of mortality from TB alone.9

Worldwide, it is estimated that 49 percent of people with both diseases are unaware of their co-infection due to not being tested,¹⁰ and therefore fail to receive the necessary care.

Another challenge to diagnostics is painfully simple: distance. In emerging countries like India, testing centres are more prevalent in cities. Simply reaching a test centre can be difficult or costly for poorer people in rural areas,¹¹ even if the test itself is subsidised. Simple measures, however, such as providing transport subsidies could boost access to testing, as noted in a study of low-income rural TB patients in China.12

A 2017 report on a survey that focuses on viral hepatitis testing in low- and middleincome countries, including Southeast Asia, noted that it was common for patients to have to foot the bill — another barrier to getting people diagnosed.¹³ "In terms of future policy," the report explained, "there is scope for involving non-health workers with task-shifting to promote testing as achieved with HIV." The authors added that increased testing requires multiple factors that need to combine, such as bolstered community awareness, healthcare worker training, building robust national strategies, and better access. Because to make headway in managing these infectious diseases effectively, governments must build an interlinked chain reaction of success.

Big Targets, Better Collaboration

It is clear that a coherent strategy for diagnosis and treatment needs to be in place to improve healthcare access. The WHO states that "we need to improve data systems, diagnostics, laboratories and drug supply, and provide better linkages with other services [...] using integrated service delivery models such as 'one-stop shops'."¹⁰

It is clear that *a coherent* strategy for diagnosis and treatment needs to be *put in place.*

Furthermore, the WHO aims for a 90 percent reduction in new chronic hepatitis infections.¹⁴ The target for TB is an end to the disease by 2035.15

To achieve this, however, testing needs to come to the forefront, by identifying new cases and starting the patient journey towards care. 16

Goals like this are ambitious but crucial. They provide the urgent spur the world needs, if we are to start controlling persistent infectious diseases.

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A Doctor's **Struggle with COVID-19**

Dr Ning Zhou, a cardiologist at Tong ii Hospital in Wuhan. China, shares his story of being infected with the novel coronavirus - and returning to the front lines after recovery.

January 2020 — doctors in Wuhan, Hubei, China, witnessed a spate of pneumonialike cases of unknown cause.¹ By the time this was reported to the World Health

There used to be less than 10 patients in the hospital's fever clinic a day, shares Dr Zhou, but staff suddenly began seeing up to 100 patients daily. What Dr Zhou and

Organization's China Country Office on New Year's Eve,¹ the virus had taken hold at Tong ji Hospital in Wuhan, where Dr Ning Zhou worked as a cardiologist.

his colleagues did not know at that time was that they were dealing with a novel coronavirus. Instead, it was simply called "viral pneumonia of unknown cause".

IN NUMBERS: TESTING'S ROLE IN THE FRONT-LINE FIGHT AGAINST COVID-19

The Perils of Inadequate Testing

of global COVID-19 cases on average are healthcare workers as of 14 August 2020. Testing is the only way to identify and guarantine positive cases, with World Health Organization Director-General, Tedros Adhanom Ghebreyesus saying, "You can't fight a virus if you don't know where it is."

healthcare workers in India have died from COVID-19 as of early September 2020. Potential reasons include uncertain quarantine periods, ineffective testing strategies and lack of personal protective equipment for medical workers.

As cases spiked, the medical world continued fighting against the unknown.

Within just a few days, Chinese scientists confirmed that it was a novel coronavirus and shared its genetic sequences with the world.² Armed with the genetic code, the scientific community were quickly able to start building a picture of the disease's behaviour and, crucially, how to test for it.³ (By comparison, during the 2003 SARS outbreak, this same process took three months.)⁴

Meanwhile in Wuhan, Dr Zhou recalls a patient with tachycardia entering his care on 17 January. Dr Zhou did not know it at the time, but he had encountered a suspected coronavirus patient. Dr Zhou was wearing a surgical mask, but the patient was not. It would not be until five days later that the Wuhan government made it mandatory for everyone to wear masks when outside, and to avoid close contact with anyone.5

Fever, Fatigue and More

By early February, the confirmed infections in Wuhan had surpassed 10,000,6 and the surging numbers were making residents anxious. Dr Zhou found himself overcome

How Testing Helps Healthcare Workers

reduction in transmission by healthcare workers to other people would be achieved if they were tested weekly (with results available in 24 hours). Speedy detection of infected healthcare workers, who face a higher risk of infection, allow them to quickly quarantine themselves.

with incredible fatigue after working a 24hour shift, prompting him to get a blood test.

Results revealed that he was likely to have been infected by the novel coronavirus and the physician quickly quarantined himself,

moving away to another apartment. Dr Zhou had been staying with his parents at that time, and was thankful that he had not transmitted the infection to them. He recalls that the guarantine period was challenging. Not only did he have to stay away from his family, he was also plagued with fever, cough, diarrhoea and fatigue. During that time, he was also keeping up with reports on the escalating coronavirus outbreak and was desperate to go back to

"When I talk about it, I'm always very emotional because Wuhan is my home town. Many Wuhan people, they're my friends, my colleagues, even my relatives. They needed medical help, and I'm a professional doctor - so I needed to go back to work to help them," he explains.

work in a city that was suffering from a

shortage of medical staff.

After two weeks in recovery, he was finally able to return to the front line. However, he was not prepared for the situation that awaited him.

On his first night back at work, Dr Zhou vividly realised the need for a rapid response to match the pace of a fastevolving disease. He recounts receiving

buses full of patients. Many of them were severely ill, with some "dying just a couple of minutes after arriving at the hospital". Dr Zhou adds that his team were extremely frustrated that they could not save these patients despite having both the equipment and medicine to do so.

Testing an Entire City

In May, the Wuhan government decided to double down on its diagnostic efforts to provide its residents with peace of mind as the city began to reopen, as it eventually flattened its curve. By June, Wuhan had tested nearly 10 million people through a mass campaign.7 Various strategies, including batch testing,8 were employed to raise the city's daily capacity 13-fold.

While the world was not prepared for this pandemic, the lessons learned offer valuable insights into how we can tackle the current threat and prepare for the next one. "The Chinese experience is very useful for many countries," says Dr Zhou, who has spoken at several medical conferences of how he and his team have treated the coronavirus. As he notes, only when the world comes together to share knowledge can we "find useful and effective ways to treat the coronavirus".

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IN NUMBERS: TESTING'S ROLE IN THE FRONT-LINE FIGHT AGAINST COVID-19

coronavirus cases were healthcare workers infected at work as of 5 April 2020. The low rate is the result of stringent screening and testing measures for hospital staff, including immediate testing of all staff with COVID-19 symptoms during daily screenings.

of South Korea's

Lessons from China's Experience or less confirmed cases of infected healthcare workers in Wuhan

were reported daily since 28 February, as of 12 March 2020. After the city averaged 100 positive cases in healthcare workers during January, greater availability of testing contributed to the decrease in of infected healthcare workers.

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The Lab:

Healthcare's Front-line Defence System

From mobile testing units in low-resource settings to high-end robotics, varying lab testing strategies are being employed around the world — all to overcome the unique challenges nations face during a pandemic.

COVID-19 has brought diagnostics to the world stage, ushering labs into the spotlight.

Despite our experiences from previous pandemics, Dr Ravindran Thayan, Head of Virology Unit, Infectious Diseases Research Centre, Institute for Medical Research (IMR), Kuala Lumpur, Malaysia says that many laboratories across the region weren't

equipped for the surge in testing due to COVID-19. True preparation, he adds, requires robust and consistent improvement across labs on a national level.

"It's important to equip both rural and centralised labs across the country so we can decentralise testing with appropriate risk mitigation steps. The ability to ramp

up testing quickly allows governments to develop effective containment strategies to deal with pandemics effectively and efficiently," explains Dr Thayan.

Healthcare's Intelligence Unit

The success or failure in pandemic management can hinge on one space: the lab.

COVID-19, SARS and the H1N1 flu (also known as "swine flu") have shown that diagnostics do far more than simply confirm results. By aggregating the data derived from labs, countries like Singapore¹ and Taiwan² have been able to quickly identify clusters, which inform where to focus efforts to contain outbreaks.

As evidenced, an effective pandemic response strategy is supported by robust testing capabilities. Yet in labs, these capabilities are impacted by myriad factors spanning regulation, access to technology and reagents, and human technicians factors that differ hugely between developed and emerging countries.

Addressing Inherent Challenges

"The biggest gaps are inequities in the availability and accessibility of healthcare, including laboratory services," says Dr Abdul Bari Khan, co-founder and CEO of Indus Hospital in Pakistan. "At a countrywide level, these problems can be addressed by improving the public health system and encouraging public-private partnership models which aim to deliver free or subsidised healthcare."

At a regional level, Dr Thayan calls for "pandemic-proof" supply chains that ensure consistent flow of essential reagents, kits, and protective equipment for labs to continue operations. "With the lockdowns and countries closing their borders because of COVID-19, that was a huge challenge for laboratories. Countries, and therefore labs, are so interdependent on one another. We had to source for reagents from different suppliers in such a short amount of time, just to make sure we had a steady supply to manage the

testing load. Thankfully we had enough resources to scale up testing when required."

On a global level, strengthening the capabilities of labs comes down to collaboration and capacity, Dr Khan notes. "With countries supporting each other, we can reduce the global reaction time to implement an effective strategy for pandemic control." As such, he stresses, "Capacity development in countries less prepared to deal with the pandemic needs to be prioritised."

"Smarter" Testing Strategies to **Overcome Limited Resources**

Some developing economies, however, have not been able to expand their testing capacities as quickly. Many struggle to access the diagnostic tests needed due to limitations in resources, support and regulations.³ For instance, the polymerase

"You must be able to catch cases early through testing."

Dr Ravindran Thayan, Head of Virology Unit, Infectious Diseases Research Centre, Institute for Medical Research (IMR), Kuala Lumpur

chain reaction tests which are considered the most reliable form of diagnostic for COVID-19 are costly to administer⁴ and require specialised equipment to process.⁵ Emerging labs have had to pivot to "smarter" testing strategies because of these limitations.

One viable alternative for prompt diagnosis is rapid test kits, offering fast portable point-of-care testing.6 This not only saves time, but allows diagnostics to be taken to villages and smaller towns, where access to testing is far more limited.

Similarly in Malaysia, Dr Thayan says his organisation is also looking into the possibility of "plug and play" mobile labs for areas with limited access to testing, or at entry points such as airports. "While molecular testing will still be the 'gold standard' of testing, we need to think about ways to make testing more accessible and mobile. You want the test to be immediate so that once you know a person is positive, you can then manage and contain them quickly," he explains.

The Power of Automation

With the flood of samples that need processing and the prevalence of staff fatigue,7 human-induced errors in labs are inevitable, especially during a pandemic. This can lead to contagious people being cleared as COVID-free.

As such, experts are calling for more rigorous lab processes, from adoption of barcode testing to interfacing with electronic patient medical records. However, even for low-resource labs, simple changes to training, such as incentivising staff to find and report any labelling errors they spot,8 can make a difference.

In high-resource labs, automation allows for greater quantities of tests to be processed while reducing human error and lab infection.9

"With increasing demand, automation becoming almost indispensable, lab

Yong S, Anderson D, Wei W, et al. (2020). Connecting clusters of COVID-19: an epidemiological and serological investiga The Lancet Infectious Diseases, 20(7), 809-815. https://doi. ²Cheng H Y, Li S Y, and Yang, C H. (2020). Initial rapid and proactive response for the COVID-19 outbreak - Taiwan's experience. Journal of the Formosan Medical Association Taiw ri zhi, 119(4), 771–773. https://doi.org/10.1016/j.jfma.2020.03.007 ³ McNerney R. (2015). Diagnostics for Developing Countries Diagnostics (Basel, Switzerland), 5(2), 200–209. https://doi. ⁴Knight G M, Dyakova E, Mookerjee S. et al. (2018). Fast and

modelling study to explore screening for carbapenem resistance in UK hospitals. BMC Medicine, 16(141). https://doi.org/10.1186/ \$12916-018-1117-4 Behnam M, Dey, A, Gambell T, and Talwar V. (2020) COVID-19: Overcoming supply shortages for diagnostic testing McKinsey & Company. Retrieved from https://www.mckinsey. com/industries/pharmaceuticals-and-medical-products/our nsights/covid-19-overcoming-supply-shortages-for-diagnostic

challenges blunting response effectiveness? AAS Open Research

workers need to be trained in the handling of technology and managerial skills, as well as administrative techniques," says Dr Khan. These, he says, will be more in demand as automation dispenses with technical human skills.

According to Dr Thayan, automating a lab is a good opportunity to improve workflow and efficacy of a lab. He adds, "It also frees up our technicians who can then be developed and trained to manage a lab, probably in a part of our country that requires more resources. As part of future-planning, this is an effective strategy to build up the lab infrastructure across a country, and bring testing capabilities to areas that severely need it."

A Pivotal Partner: Advancing the Role of Laboratories

The shift to move away from "result generators" to "data aggregators" has been in the making for a while now but the peri- and post-pandemic world has perhaps accelerated the need for labs to be front runners in this new age of healthcare.

At each stage of pandemic management, the lab holds intelligence gathered from patient data on a national scale. This can provide policymakers and clinicians with key insights they need to make the right decisions. "From early detection, screening populations, monitoring disease progression, and even assessing the efficacy of a vaccine — the lab is always there. It's up to us to advocate for continuous development and improvement of laboratories. What we do today will determine how prepared we are for tomorrow," says Dr Thayan.

Kobia F, and Gitaka J. (2020). COVID-19: Are Africa's diagnos

Scott K. (2020). Advancing Standards for Specimen Labeling and Fracking. American Association for Clinical Chemistry. Retrieved rom https://www.aacc.org/cln/articles/2020/june/advancing Ford B A, and McElvania E. (2020). Machine learning takes

Jaboratory automation to the next level. Journal of Clinical Microbiology. 58:e00012-20. https://doi.org/10.1128/JCM.00012-20

expensive (PCR) or cheap and slow (culture)? A mathematical

^{3, 4.} https://doi.org/10.12688/aasopenres.13061.1 ⁷Tan SS, Yan B, Saw S, et al. (2020). Practical laboratory considerations amidst the COVID-19 outbreak: early experience rom Singapore. Journal of Clinical Pathology. https://doi org/10.1136/jclinpath-2020-206563

"Protecting our Communities is Integral to National Health": Dr Rob Grenfell

From Public Health Physician to National Health and Biosecurity Director

How did a qualified public health physician and GP with almost 30 years' experience in the public and private sectors find himself facing not one but two pandemics?

The Swine Flu Pandemic Hit Around a Month into My Appointment with the Department of Health Victoria I joined the Department of Health for the State of Victoria as a senior advisor for prevention and population health early in 2009.

When swine flu hit, I saw how a pandemic is managed inside a health department. The magnitude of the challenge ahead of you, the speed with which you react, were valuable lessons.

Following this, I spent many years in directorial roles at the Heart Foundation and Bupa Australia and New Zealand before joining the Commonwealth Scientific and Industrial Resarch Organisation (CSIRO) in 2016. Australia's national science agency was formed, believe it or not, a little before the influenza pandemic of 1918, with the idea of ensuring scientific interventions could protect national health.

At CSIRO, the focus of the team I manage is health and biosecurity: I describe biosecurity as a way of predicting or preventing potential bio threats, be it insects, microbes or viruses, through to the idea of how you detect and manage these challenges.

I have one of the few teams globally that can deal with the most dangerous pathogens in the world. Perhaps Nothing is More Dangerous than Misinformation

Managing a pandemic at the height of social media, where the alarming speed with which mistruths can be disseminated, is a challenge that the scientific community around the world is grappling with.

In all my years in public health, I never imagined we would need to consider such an "infodemic", as the World Health Organization has categorised it.¹

COVID-19 is Endemic

The most sobering reality is that COVID-19 is not going away. Infectious disease management requires public health interventions on a national scale, and the success of these really depends on cooperation from the public. We will have to find a way to live with this virus, as we have with others like influenza and tuberculosis.

What we have of course managed to do relatively well in Australia is to bring things under control. But it is important to understand that recurrences are likely and there's a time limit to lockdowns and restrictions. These cannot go on indefinitely. Finding solutions that can control COVID-19, in the long run, is the real task.

Dr Rob Grenfell is Health Director of Health and Biosecurity at the Commonwealth Scientific and Industrial Research Organisation

It's all well and good to do track and trace and quarantine as public health measures and that works. But if we can be more precise as to who's infectious, who's not and allow a very pointed management of infectious cases, even without a vaccine or therapies, this will allow us to open up borders, start travel and trade. It will also allow us to bring people back into the workplace, so that we don't necessarily jeopardise the health of the whole population. Diagnostics is the absolute bedrock for a response in any of these settings.

Work of the CSIRO Health and Biosecurity Team Our priority at the moment is managing our response to the COVID-19 pandemic,

"I have one of the few teams globally that can deal with the most dangerous pathogens in the world." "In all my years in public health, I never imagined we would need to consider such an 'infodemic'."

but the most important part of biosecurity is the recovery phase — and that's the part that needs a lot of work.

My team and I are currently working on nearly 250 COVID-19 projects, including pre-trial work on the coronavirus vaccine in partnership with the Coalition of Epidemic Preparedness Innovations (CEPI).

The sheer pace of it all can be overwhelming at times. But it is a privilege to do our part in protecting Australia and sharing our discoveries with the world.

The Move Towards a Vaccine is Taking Shape

We've seen some encouraging early results and global efforts may yield a vaccine. There has never been a coronavirus vaccine for humans and we only need something that's about 50 percent effective to really change the shape of what's going on.

However, it doesn't mean that a vaccine will solve this problem straight away.

We will need to continue a lot of solid measures, building on our understanding of this virus and refining drugs, but also diagnostics, to tackle it.

Pandemics tend to occur at **10- to 50-year** intervals.

4 most recent influenza pandemics: 1918, 1957, 1968, 2009²

What Does Normal Look Like, Post-COVID? People over the age of 75 are at severe risk. Working on how this part of the population can coexist with other subsets that don't have problems with the virus is going to be a challenge. I think aged care settings will need to be adjusted.

What sort of life is it for your grandparents if they can't see you, or you can't hug them because you might give them the virus? The fatality rate at that age is very high, so that's a real problem for quality of life for anyone in that setting.

The other problem that's emerging is the chronic effects of the viral infection. We're now seeing in young children inflammatory conditions like Kawasaki disease and other neurological chronic conditions. This is not a simple infection.

We have to balance these risks with the return to normal life. And none of these are easy questions to answer.

More Outbreaks will Come Disease X — the next global pandemic — might be an influenza, or a coronavirus, because we've already had SARS and MERS. Or it might be another agent, like an Ebola, or something like Nipah virus. Having a unified approach globally, and also having a systematic approach, is key. We need to be investing an enormous amount into that type of approach to diagnostics and drugs.

It's an awful lot of work we're going to do over the next few years. It is also what keeps me going.

There are Positive Lessons We can Learn We've seen collaboration at a global scale. How do we do more of this to work together to actually solve global problems?

If we can do this with a vaccine, why can't we do this with everything else that needs to happen on the planet, to make this a much better and more equitable place for all of us?

¹World Health Organization. (2020). Managing the COVID-19 infodemic: Promoting healthy behaviours and mitigating the harm from misinformation and disinformation. Retrieved 30 September 2020, from https://www.who.int/news-room/detail/23-09-2020-managing-the-covid-19-infodemic-promoting-healthy-behaviours-and-mitigating-the-harm-from-misinformation-and-disinformation ² World Health Organization; 2018. Managing epidemics: key facts about major deadly diseases.

People are different and so are diseases.

That's why we are committed to discovering and developing personalised medicines and targeted diagnostic tests to help people live better, longer lives.

