BLACK SWAN

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BIOSECURITY IN THE INDO-PACIFIC REGION

DEFENCE AND SECURITY THROUGH AN INDO-PACIFIC LENS

UWA DEFENCE & SECURITY

THE UNIVERSITY OF WESTERN AUSTRALIA

Cover Image Soldier wearing camouflage uniform and wearing a black rubber respirator.

Inside Cover Image Test for Covid-19. Nurse doing a lab analysis of a nasal swab in a hospital laboratory.

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Images courtesy of the Department of Defence.

Please direct inquiries to peter.dean@uwa.edu.au

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UWA Defence and Security Institute
M235, 2nd Floor, Old Economics Building (Bldg 351)
The University of Western Australia
35 Stirling Highway
Crawley WA 6009
Australia

For all general enquiries:
Email: defenceprogram@uwa.edu.au
Tel: +61 8 6488 4742

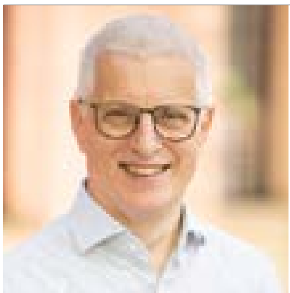
About the editor

Professor Peter J. Dean

The Black Swan Strategy Papers are edited by Professor Peter J. Dean, Chair of Defence Studies and Director of the UWA Defence and Security Institute. A specialist in Australian strategy and Indo-Pacific security, he is a non-resident senior fellow with the Atlantic Council and a visiting fellow at the Strategic and Defence Studies Centre at The Australian National University. Professor Dean has been a Fulbright Fellow and Endeavour research scholar in Australia-United States alliance studies, and was the co-founding editor of the Melbourne University Press *Defence Studies Series*. He is also a member of the editorial board of the *Australian Army Journal*, *Global War Studies* and the *Military Studies Journal* and a former managing editor of the journal *Security Challenges*.

(E) peter.dean@uwa.edu.au

About the author



Associate Professor Tim Inglis

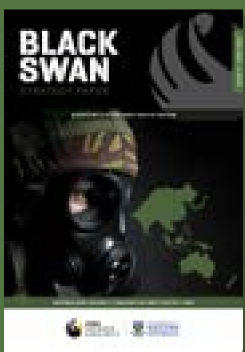
Associate Professor Tim Inglis (Pathology) Health Department of Western Australia Translation Fellow, School of Medicine, UWA and Medical Microbiologist, PathWest Laboratory Medicine, WA.

Dr Inglis has medical degrees (BM, DM) from the University of Southampton, UK, and a PhD from the University of Western Australia.

He has 149 PubMed-listed peer-reviewed publications and has also published patents, chapters and books on clinical microbiology and infectious diseases. His peer-reviewed publications focus on field investigation of emerging infections including COVID-19, drug resistant sepsis, and neglected tropical infections with the common theme of clinical capability development.

(E) tim.inglis@uwa.edu.au

Expert review panel: Professor M Reade, UQ; Dr G Lum, Department of Health, Commonwealth Government, and Dr D Eagles, AAHL, Geelong.



About the Black Swan Strategy Papers

The *Black Swan Strategy Papers* are the flagship publication of the UWA Defence and Security Institute (DSI). They represent the intersection between Western Australia and strategic studies – both of which are famous for their black swans. The series aims to provide high-quality analysis and strategic insights into the Indo-Pacific region through a defence and security lens, with the hope of reducing the number of 'black swan' events with which Australian strategy and Indo-Pacific security has to contend. Each of the Black Swan Strategy Papers are generally between 5,000 and 15,000 words and are written for a policy-oriented audience. The Black Swan Strategy Papers are commission works by the UWA DSI by invitation only. Any comments or suggestions for the series can be directed to the editor.

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Executive Summary

The wide influence of the COVID-19 pandemic on policy development dictates that a COVID-19 lens be used to view biosecurity in the Indo-Pacific region. Biosecurity provisions, practice and policy can be set on a COVID-19 pandemic timeline to understand our biosecurity's origins, current limits and future priorities.

The region's biosecurity in the pre-pandemic era will be contextualised through the colonial period, the immediate post-colonial period and into the early years of the 21st century. The impact of the COVID-19 pandemic on regional biosecurity will then be considered in terms of immediate crisis management, divergent pandemic control strategies; and the era of mass vaccination.

Finally, the central theme of restoring interpersonal, interagency and international trust in biosecurity provisions will be explored in anticipation of a post-pandemic period.

POLICY RECOMMENDATIONS

- Biosecurity suffers the consequences of being out of sight and out of mind.
- Biopreparedness is often no more than a collection of lessons learned from past biothreat incidents.
- Much can be learned from how the Indo-Pacific region has handled the COVID-19 pandemic.
- The COVID-19 pandemic demonstrates biotechnology's power and its operational limits.
- Further emerging biosecurity threats demand new diagnostic, pharmaceutical, surveillance and preventive countermeasures.
- These emerging threats require a strong scientific and technical sector, which needs post-pandemic repair.
- Real time data analysis developed for biothreat assessment during the pandemic has wider application to operational health intelligence.
- Stronger collaborative networks among Indo-Pacific regional players are required to generate timely actionable analysis.
- The predominant risk-averse biothreat mindset must be replaced by a risk-adept ethos through executive support for a high-flow innovation pipeline and community-wide adoption of disease risk-management skills.
- Application of all-threats disaster management to COVID pandemic recovery represents an opportunity to reinforce regional biosecurity and enhance pandemic preparedness.
- Biosecurity needs professional leadership and governance, and a national budget for early warning, crisis response and consequence management.

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Routine clinical tasks needed revision for conduct by health workers wearing protective equipment.

INTRODUCTION

Definitions

Biosecurity is the product of a collection of measures taken against biological threats to human health, agriculture, native flora and fauna, and the environment.

These combine the fields of human, veterinary and environmental health, and aim to counter established, recognised exotic (external) and emerging contagious biological threats. Human biosecurity is a part of health security and intersects with agricultural, native animal and plant, and environmental biosecurity.

Specific biological threats (diseases, pathogens or toxins) are defined by international, national and jurisdictional agencies in formal lists and supported by response plans. These vary according to priority, surveillance capacity and response capability, and only rarely include mechanisms for handling a novel or emerging infectious disease. The overall ability to respond to a biosecurity threat is known as ‘biopreparedness’.

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Healthcare worker using a Covid-19 antigen test.

CHAPTER 1

Pre-pandemic

The colonial era

After gaining access to the Pacific and Indian Oceans, establishing trade routes, and mapping their coasts and hinterlands, the colonising Europeans discovered the adverse effect of exotic diseases that were previously unknown in Europe. Malaria dominated the early efforts of the European schools of tropical medicine, but there were other tropical diseases such as the parasitic disease schistosomiasis, mosquito-borne viral infections, scrub typhus, typhoid, and cholera. Mastery of these biological threats was essential to colonial trade, commerce and civilian settlement. The schools of tropical medicine and hygiene were established to support outposts in the major colonial territories by training generations of doctors, nurses, colonial administrators, traders and missionaries in disease prevention, diagnosis and treatment. The insights obtained by generations of graduates from these schools helped geographically distant powers maintain their colonial possessions and influenced decisions on where to locate major settlements throughout tropical Asia. At the start of the Pacific War in 1941, cinchona plantations in Indonesia (then known as the Dutch East Indies) were an attractive prize to foreign invaders who needed a source of quinine to treat malaria in their occupying troops. Denied this valuable force protection asset, the Australian Army Malaria Institute commenced research into alternative antimalarials and treatment for other tropical diseases such as scrub typhus arising from jungle warfare. During Japan's dominance of the Far Eastern theatre, the notorious Unit 731 established a forward experimental biological warfare station in Singapore. Japanese occupiers also co-opted the medical entomology laboratory in Kuala Lumpur's Institute of Medical Research.

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Lieutenant-General Arthur Percival surrenders Allied forces in Singapore, 1942.

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Research scientist testing specimen in petri dish in laboratory.

A matter of intent.

The contrasting activities of Allied and Axis military research units in the region during the Second World War demonstrate the difference between offensive and defensive use.

Unit 731 was set up by the Japanese Imperial Army in 1935 as part of the Epidemic Prevention and Water Purification Department to conduct covert biological and chemical weapon development in Harbin. Unit 731 and its branches in other parts of China and Southeast Asia ran a biological weapons program from development, testing, production and storage to deployment in field trials against human populations. [1] Unit 9240, a regional branch in Malaya and Singapore, specialised in plague and malaria prevention, but was believed to have engaged in biological weapons production. Live human experiments were conducted by unit 731, directly causing the death of up to half a million prisoners, including prisoners of war. Its commander, General Shiro Ishii, was given immunity from war crimes prosecution in exchange for detailed results of the human experimental program to assist Western powers in their biological weapons programs. Other senior staff went on to lead civilian health organisations in Japan. In Australia, the Malaria Research Institute also conducted work on malaria prevention to protect Allied troops deployed in the Pacific Theatre [2]. Pioneering work on dengue and scrub typhus was conducted in field studies in the Western Pacific which gave rise to post-war work on these and other vector-borne diseases. No offensive work was conducted, though other Australian units conducted human exposure experiments with sublethal chemical weapon agents. Staff of what became the Army Malaria Institute went on to develop diagnostic methods, treatments and vaccines. Perhaps the most notable of these was Frank Fenner, who became a key player in the global eradication of smallpox.

1. Gold H. Japan's Infamous Unit 731. First-hand accounts of Japan's wartime human experimentation program. 2019, Tuttle Classics. ISBN: 0804852197
2. Quail GC. Lessons Learned. The Australian Military and Tropical Medicine. 2017. Big Sky Publishing Pty Ltd, Newport, Australia. ISBN: 9781925520224

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Laboratory handling of biothreat agents requires a higher level of biosecurity precautions than routine clinical specimen handling. Approved biosecurity laboratories are subject to rigorous government regulation.

The immediate post-colonial era

The retreating colonial powers left behind a patchwork of public health laboratories and research institutes in the Indo-Pacific region that had been built around their needs and priorities. While some, such as the Institute of Medical Research in Malaysia and national Pasteur Institutes, established a foundation of field work and outreach, they were often located in urban centres and could easily be referred by phone or surface mail to overseas centres of excellence with which they had historic ties and established collaborations. In much of the region, a prolonged period of war, internal conflict and insurgency disrupted attempts to improve public health. The emergence of international agencies, such as the World Health Organization and its regional offices, did little to bring cohesion to regional biosecurity. During this period, public health experts in the region relied on an expanding repertoire of antimicrobial agents and vaccines to see off biothreats and shifted their gaze to the growing global burden of non-infectious diseases such as diabetes, cancer and cardiovascular disease.

When smallpox was finally eradicated by a successful international vaccination program, only the two dominant superpowers, the USA and the USSR, retained secure stocks of the virus against a future need to mass produce a vaccine. It was a reminder that superpowers outside the Indo-Pacific region still had a potential biological warfare capability. The subsequent UN Biological Weapons Convention and the Australia Group listing of potential biological threat agents assumed that a rules-based world order would step away from deliberate use of biological agents in acts of war.

But reconstruction and co-incident openness (perestroika and glasnost) of the former Soviet Union were needed before the systematic dismantling of the Cold War-era Soviet bioweapon capability could be verified. The current retrenchment of Russian adversarial attitudes to Western liberal democracy, their president's flagrant disregard for a rules-based order, and his pursuit of territorial reoccupation by any means raises concerns about those stocks of smallpox virus.

A tale of two conventions.

Though often lumped together as 'chemical and biological weapons', these two categories are covered by distinct international conventions. Unlike the Biological Weapons Convention (BWC) of 1975[1], the UN Chemical Weapon Convention was ratified later (1997) and its provisions for verification and enforcement strengthened. Biological weapons, whose detection is often more technically demanding, are regarded by international monitoring groups as difficult to attribute and seen as more easily deniable by aspiring perpetrators. Though used mainly by non-state actors, recent examples such as powdered anthrax spores in the USA during 2001 show how difficult forensic attribution can be, and how long an investigation can drag on for. The long lead time to definitive laboratory results provides ample opportunity for perpetrators to escape arrest. The lack of an international consensus on enforcement of the BWC led to the formation of a voluntary code of conduct between signatory nations to place export controls and reporting conditions on potential biothreat agents, which have been classified according to the level of human, animal and environmental threat. This international group is known as the Australia Group and includes 42 participants.[2]

1. Millett PD. The biological and toxin weapons convention. Rev Sci Tech. 2006 Apr;25(1):35-52.
2. The Origins of the Australia Group. https://www.dfat.gov.au/publications/minisite/theaustraliagroupnet/site/en/origins.html

After the dust settled

Events outside the region prompted a global biosecurity shift in September 2001, when reports emerged from the USA of anthrax infections that were subsequently traced to mail items handled in Trenton, New Jersey. Subsequent forensic investigation linked these anthrax spore-contaminated letters to a disaffected scientist who worked at a biodefence laboratory in the USA. These so-called 'white powder incidents' in New York and Florida unleashed a wave of copycat incidents which soon swept through the Indo-Pacific. The majority of these were malicious hoaxes, but a small proportion involved packages sent out from a mail handling centre in New Jersey.

Countries in the region were caught out by a lack of secure public health laboratory space, validated biosecurity laboratory methods, effective containment methods and secure inter-agency communication protocols. Australia was better prepared than many due to earlier biosecurity preparations for the Sydney Olympic Games in 2000, which included molecular diagnostic equipment for the major public health laboratory nodes. The 2001 white power incidents were highly disruptive of business continuity. However, they had the unexpected benefit of showing up critical capability gaps and triggered a cycle of policy wrangling and procedure development. The flow-on effect was that the language of biosecurity began to permeate public health agencies and their laboratory arms. Lasting conversations were established between staff of human health, veterinary health, first responders and security agencies. These administrative adjustments were necessary but did not, of themselves, amount to substantial capability development.

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Respiratory protection used by decontamination team following anthrax incident in Boca Raton, Florida, 2001.

Whiteout.

Following the deliberate dispatch of anthrax spore-contaminated mail via the US postal service resulting in serious human infection, a wave of copycat white powder incidents followed around the world.

These were a mixture of false alarms and hoaxes which proved highly disruptive to civil authorities, their fire and emergency services and public health laboratories in 2001.[1] Media interest stirred up by the immediate aftermath of the destruction of the World Trade Center in New York and fed by deliberate anthrax spore distribution shone a spotlight on local white powder incidents and encouraged perpetrators until measures were put in place to prosecute them for serious criminal offences. The public health laboratories had to develop analytical methods from scratch during a wave of white powder incidents. Nationally consistent laboratory procedures were needed, despite a shortage of suitable high level biological containment laboratories and the specialist expertise to handle exotic microbes in them. This capability gap was bridged in the long run by interagency and inter-state cooperation, leading to a clear division of responsibilities, agreed standard procedures and a quality assurance process.

1. James G, Yuen M, Gilbert L. Laboratory investigation of suspected bioterrorism incidents, NSW, October 2001 to February 2002. 2003, N S W Public Health Bull. 2003; 14: 221-223.

←
Workers wearing biohazard suits, sorting through packages at a mail centre.

This required a further series of emerging epidemic threats.

By the time influenza H1N1/09 ('swine flu') appeared in 2009, well-resourced countries like Australia were better able to formulate and deploy a just-in-time molecular diagnostic response to cope with the surge. As the availability of molecular diagnostic methods ensured evidence-driven public health interventions, this capability arguably reduced the scale of the crisis and accelerated the transition from crisis to consequence management. The downside was that policy makers believed they had managed so well that they failed to learn strategic lessons about over-reliance on local academic institutes, access to offshore sources of biotechnology, complex regional supply chains and adverse epidemic effects on the regional economy.

Through this period, agencies such as the Global Outbreak Alert and Response Network (GOARN) played an important role in strengthening response capacity in regional low- and middle-income countries (LMICs) such as Vietnam, Indonesia, Malaysia and the Philippines. But as GOARN relied heavily on volunteer contributions from wealthy nations, it lacked the ability to come to the aid of LMICs when everyone simultaneously faced the same epidemic threat. However, the network showed its regional value during the first severe acute respiratory syndrome (SARS) epidemic, when GOARN mobilised quick-response teams to assist vulnerable countries like Vietnam.

Actions taken in the heat of the moment and during the H1N1/09 influenza epidemic against the emerging existential threat seemed extreme but gave the region a glimpse of what was needed to counter a rapidly transmissible and potentially fatal biological threat like SARS. Unfortunately, international fora such as the United Nations were distracted by geopolitical issues such as the exercise of authority by the World Health Organization's Secretary General and missed the biosecurity lesson hiding in plain sight; that SARS was not a one-off, 'black swan' event. It was a demonstration of the threat posed by a particular family of viruses, to be ignored at our peril.

In addition, veterinary biosecurity officers have expanded their toolkit of control measures in a series of regional successes through prompt intervention, often involving timely international collaboration. These include responses to outbreaks ('spill-over events') of Nipah virus and Hendra virus. But established, internal biothreats such as European fruit fly, cane toads, carp or aquatic weeds can prove impossible to eradicate. These threats are notable because they are not considered a direct risk to human health, despite adverse effects on food security, whereas contagious diseases that affect both humans and livestock trigger more rapid decisive action.

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Cooperation on emerging biothreats requires input from multiple agencies, often outside the experience of front-line clinical staff.

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Scientists inspecting disaster site.

Think global, act local.

The World Health Organization set up a global outbreak and response network (GOARN) to build up international cooperation on epidemic management during the first decade of the century.

GOARN sprang into action during the first SARS epidemic and is credited with contributing to bringing the epidemic under control.[1] Noting that there were other important contributors to that outcome, the first SARS epidemic was a demonstration of the value of a networked response to a rapidly transmissible emerging infectious disease. However, prompt disease control was not received well in some circles where reputations had been bruised by the epidemic's impact on the regional economy. GOARN languished in the following decade and appears to have been kept on a tight rein while other organisations such as the European Mobile Laboratory came to prominence through notable epidemics, including the 2014-15 Ebola disaster in West Africa.[2] A common theme emerging from each of these successive epidemics has been the need to rapidly upscale public health laboratory capability and capacity in low- and middle-income countries to enable data-driven disease control efforts. Insertion of mobile laboratory capability across international borders into a public health disaster zone is a fusion of medical diplomacy and health logistics that remains a work in progress.

1. Burkle FM Jr. Global Health Security Demands a Strong International Health Regulations Treaty and Leadership from a Highly Resourced World Health Organization. Disaster Med Public Health Prep. 2015; 9: 568-80.
2. European Mobile Laboratory Project, background: http://www.emlab.eu/background.html

CHAPTER 2

The year of living cautiously

In early 2020, the Indo-Pacific region slowly awoke to the implications of a transmissible disease that was first reported from Wuhan Province, China, in late 2019. Its rapid spread, high morbidity and mortality, and the extraordinary measures used to counter it prompted speculation in professional circles about the threat to the rest of the region.

Crisis management

The arrival of COVID-19 caught many parts of the Indo-Pacific region under-prepared, despite previous experience with SARS. The first wave of infection left some countries such as Vietnam with a weak public health infrastructure relatively unscathed. Other highly urbanised populations in the region, such as parts of Indonesia, suffered badly. Those with an aging middle class, high levels of diabetes and other co-morbidities had increased risk of severe or fatal disease. Countries like Singapore (E), with strong public health and highly disciplined biosecurity delivery, still encountered a high prevalence of COVID-19 in their expatriate construction workers who lived in dormitory accommodation.

Locally, well-connected professionals reached out to obtain the SARS-CoV-2 genetic sequence data needed to set up sophisticated molecular diagnostic tests to confidently diagnose COVID-19.

Once this had been shared with leading academic institutes, Australia was able to detect the SARS-CoV-2 virus and subsequently grow the virus in a controlled access, high-level biosecurity laboratory. Thus the stage was set for diagnosis, test standardisation and monitoring of genetic variations in SARS-CoV-2 as the virus continued to mutate. Soon afterwards, every major public health laboratory was able to use molecular diagnostic tests to confirm COVID-19, calibrated against that initial laboratory work.

During the first few weeks of the pandemic, or the 'first wave', the public health response was disorganised in some parts of the region where epidemic emergency measures took time to mobilise. Thus Indonesia saw a rapid escalation of COVID-19 cases. However, much of the Indian Ocean rim, particularly Sub-Saharan African countries, the Indian subcontinent, and parts of Southeast Asia saw surprisingly low COVID-19 caseloads. The reasons are still debated and include lower mean age of population, lower lived density, lower access to molecular diagnostic technology, and cultural attitudes to disease. In Australia, the public health response was governed by disaster response legislation that placed the main hazard management responsibility in the hands of health authorities. For the first few weeks, key public health officials were guided by existing plans, experience handling past outbreaks, and specialist training.

The first few weeks of the COVID-19 pandemic forced the re-writing of the written procedures, since the emerging pandemic did not closely follow the previous SARS trajectory. Public health physicians and their respective laboratories set up emergency operations centres, coordinated regular communications with other agencies, including police forces, and organised logistic support to overcome the varying levels of movement restriction that applied to the wider community. The initial search-and-destroy approach taken in Australia and New Zealand was particularly onerous on contact tracers, specimen collectors and public health laboratories, whose ability to handle more commonplace biosecurity threats was sidelined to allow a more concentrated COVID response.

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Drive-through COVID testing clinics have become a familiar sight during the pandemic.

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The personal touch.

In the early stages of international expansion of the COVID-19 pandemic, a direct communication between researchers in Sydney and Wuhan led to the prompt transmission of SARS-CoV-2 genome data.[1] This, in turn, enabled a biomedical research centre in Melbourne to develop PCR assays to detect and confirm the presence of SARS-CoV-2 in Australia. From there on, Australia was well placed to develop and validate laboratory tests for COVID-19. These have become the mainstay of laboratory-confirmed SARS-CoV-2 infection by sharing positive control material through a national public health laboratory network to benchmark PCR tests in each state and territory. Widespread availability of nationally benchmarked tests provided public health operations centres with the assurance they needed about infections through the early stages of the pandemic. The foundation of that prompt mobilisation of molecular diagnostic capability was collegial international academic collaboration, intersecting with a critical mass of virology expertise and rapid dissemination via a public laboratory network. Without such prompt activation of a nationally consistent test program through connected individuals, Australia's early suppression of COVID-19 within its borders would have been much more difficult.

1. Holmes EC, Goldstein SA, Rasmussen AL, Robertson DL, Crits-Christoph A, Wertheim JO, Anthony SJ, Barclay WS, Boni MF, Doherty PC, Farrar J, Geoghegan JL, Jiang X, Leibowitz JL, Neil SJD, Skern T, Weiss SR, Worobey M, Andersen KG, Garry RF, Rambaut A. The origins of SARS-CoV-2: A critical review. Cell. 2021;184: 4848-4856.

Divergent pandemic paths

Not every country in the Indo-Pacific region opted for COVID elimination, after closing their international borders to no more than a few essential travellers. Elimination, sometimes known as 'COVID zero', was an idea that grew out of successful disease suppression in parts of Australia and in New Zealand. This strategic objective turned into a wishful expectation that COVID-19 would in time be eliminated through strong non-pharmaceutical interventions (NPI) and mass vaccination. However, most regional low- and middle-income countries lacked the public health infrastructure to fully control the first pandemic wave. In some cases, the poorest countries in the region did not have publicly funded molecular diagnostic capability, so that any reports of PCR-confirmed cases were likely to underestimate the scale of the threat.

In extreme cases, such as in Tanzania (A), national leaders stubbornly denied the significance of the impending threat and even interfered with the way positive tests were reported. This may seem incomprehensible to those with a scientific worldview, but is only a small measure of the diversity of political, cultural, linguistic and technological capability within the region. For example, how much effort was made to grasp the impact of pandemic advice from international agencies in European languages that are not widely used by the general population? If complex scientific ideas cannot be clearly expressed in the lingua franca, it is hard to impress the subtleties of past exposure to SARS-CoV-2, pre-symptomatic infectivity, and subsequent COVID progression. This is especially true of the time-critical nature of a rapid diagnostic test and prompt intervention.

Despite these linguistic obstacles, smaller Asian nations like Vietnam and Taiwan made efficient work of the early public health task.

Within nation states such as Australia, the different pandemic trajectories in different subnational jurisdictions have led to wide differences in the timing of countermeasures, to the point where they put national political cohesion at risk. This underlines a fundamental weakness in a federal biosecurity framework that has limited buy-in by the operational arms of health, veterinary and environmental pandemic response. These agencies rely heavily on their subordinate jurisdictions. In this respect, Australia is a microcosm of pandemic response diversity, with a troubling divergence of opinion on the best way to proceed.

The decline of delta.

During 2020, the aim to suppress the COVID epidemic curve changed into a de facto COVID elimination strategy, mirroring what New Zealand and some Australian states appeared to have achieved. Bit by bit, the credibility of COVID elimination came under criticism, as successive waves of new SARS-CoV-2 variants appeared in the Indo-Pacific region.[1] Though initially successful, suppression of the major variants of concern (VOCs) began to slip as the delta variant came to prominence, most notably in the Indian subcontinent. The delta, omicron and mu VOCs represent the latest layers of the COVID pandemic, seen by some as mini-pandemics in their own right, since each new VOC can come to dominate the region. Omicron is a highly successful variant with enhanced transmission rates and increased resistance to vaccination. Further virus mutation will enable these novel VOCs to acquire additional features that assist transmission, disease severity and vaccine escape.[2] It is clear now that SARS-CoV-2 will continue to challenge public health, its laboratory underpinning and the pharmaceutical industry for months and possibly years to come. Low- and middle-income countries in the Indo-Pacific region often have weak public health infrastructure and limited biopreparedness and are thus vulnerable to these new VOCs. Without significant assistance from neighbouring states, they will remain a potential reservoir for reinfection. Preparedness has a regional dimension.

1. Kwok KO, Huang Y, Tsoi MTF, Tang A, Wong SYS, Wei WI, Hui DSC. Epidemiology, clinical spectrum, viral kinetics and impact of COVID-19 in the Asia-Pacific region. Respirology. 2021 Apr;26(4):322-333. doi: 10.1111/resp.14026.
2. Raman R, Patel KJ, Ranjan K. COVID-19: Unmasking Emerging SARS-CoV-2 Variants, Vaccines and Therapeutic Strategies. Biomolecules. 2021 Jul 6;11(7):993. doi: 10.3390/biom11070993.

Elimination, sometimes known as 'COVID zero', was an idea that grew out of successful disease suppression in parts of Australia and in New Zealand.

The extent to which a highly transmissible virus can exploit the consequent lack of administrative cohesion demonstrates the critical importance of national and regional consensus building. WHO-led work on an international pandemic countermeasures treaty is timely (B).

After a large, multistate outbreak in 2021 then the arrival of the highly transmissible omicron variant, the Australian COVID-19 strategy shifted from suppression to elimination within the community (COVID zero), and then to 'living with COVID'. With an unseen adversary inside controlled borders, the strategic objective changed from a search-and-destroy campaign to a pragmatic counterinsurgency, and in some states, capitulation. Those familiar with counterinsurgency operations will recognise the heightened complexity, ambiguity, moving decision points, elastic timeline, and opaque exit strategy of the latter stages of this pandemic. These features of the global biothreat converge in a battle for ideas that stretched from committee rooms to the echo chamber of social media. Thus it was easy to miss key pressure points such as the interagency cooperation required to manage infection control procedures for the crew of incoming merchant vessels, or to stand up and mobilise rapid deployable laboratory teams to run SARS-CoV-2 tests in remote regional communities. It will only be possible to form an objective view of the practical lessons learned from all this when the dust settles and there is time for a dispassionate after-activity assessment.

Vaccination times

The broad impact of COVID-19 on the health and wellbeing of the global population precipitated a headlong rush for effective pharmaceutical countermeasures. Antiviral agents initially proved to be demanding, but there was rapid progress with vaccine delivery technology, in particular, with RNA vaccines that use a small portion of the virus genetic code to deliver a biological prompt to the human immune system. The vaccine recipient develops the ability to neutralise SARS-CoV-2 on future virus encounters, though efficacy of this type of vaccine is time limited. Antiviral agents may have been slow to arrive on the scene, but several new are already impacting on COVID-19 survival when started early in the course of infection.

The result of this leap in biotechnology is that, in countries with good access to COVID-19 vaccines, robust health logistics and high levels of vaccine uptake, severe COVID-19 and subsequent death have become 'an epidemic of the unvaccinated'.

This term has been criticised for oversimplifying the epidemiology of COVID-19, particularly since the moderately vaccine resistant omicron variant emerged, which is less likely to cause severe infections that demand hospital admission (C). The statistics have a remorseless logic that defies explanation by the anti-vaccination lobby. Yet the vaccine roll-out in Australia got off to a lacklustre start (D), and in low- and middle-income countries was frankly inept. Messaging around the needs for, the process to, and the consequences of vaccination has been a muddle, described by some as a vaccine 'stroll-out'.

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Attribution uncertain, possible commercial.
Figure 4. Mass production of COVID-19 vaccine

A vaccine arms race.

The preparation, validation, distribution, and delivery of multiple COVID vaccines has been one of the outstanding achievements of the pandemic. Yet it has been far from a uniform global project.[1] Wealthy countries did not deliver the promises of collaborative international initiatives and chose to prioritise vaccination of population subgroups with substantially lower benefit than the global public benefit. Before pointing a finger of blame at specific leaders, it is important to consider the complex regulatory and logistical processes that have needed to be coordinated for global distribution.[2] Now that more data has been gathered on vaccine durability, performance and adverse effects, there is greater clarity on how the program should be delivered, modified by growing evidence that booster doses will be required for months to come. When vaccine-escape mutants become an issue, enhanced laboratory surveillance and periodic vaccine updates will be necessary. This does not detract from the technological advances made in such a short time, which have potential application to other transmissible diseases.

1. Ayenigbara IO, Adegboro JS, Ayenigbara GO, Adeleke OR, Olofintuyi OO. The challenges to a successful COVID-19 vaccination programme in Africa. Germs. 2021 Sep 29;11(3):427-440. doi: 10.18683/germs.2021.1280.
2. Ahmed S, Khan S, Imran I, Al Mughairbi F, Sheikh FS, Hussain J, Khan A, Al-Harrasi A. Vaccine Development against COVID-19: Study from Pre-Clinical Phases to Clinical Trials and Global Use. Vaccines (Basel). 2021; 9 :836. doi: 10.3390/vaccines9080836.

It recently became clear that further surges of COVID-19 will occur in highly vaccinated urbanised populations such as Singapore during transition to 'living with COVID', as the SARS-CoV-2 continued to evolve. Even in well-resourced countries such as Australia, the discrepancies between the aspirations of national policymakers and those of local service providers have been compounded by a politically driven desire for ownership of successful outcomes, for example arbitrary vaccination thresholds based on mathematically modelled triggers for incremental freedoms. This unfortunate truncation of COVID-19 risk into discrete steps conflates distinct biosecurity issues and sets up a false dichotomy between a public good (biosecurity) and private freedom (e.g., freedom of movement or association).

Meanwhile, COVID-19 risk estimates derived from real-time measures of COVID-19 activity indicate that premature relaxation of public health controls in COVID-19 epidemic localities are at best cavalier and, worse, may precipitate a further round of community transmission. It is clear from work done in the Indo-Pacific region that a combination of measures will be needed to augment the vaccine effect for some time to come. Logically, this will need a light administrative touch in concert with effective public health communication. Newly emergent variants of concern such as delta and omicron drive mini-pandemics within the overall COVID-19 pandemic and renew confusion at executive, operational and task-delivery levels.

Restoration of trust

SAGO

The initial root cause analysis of the Wuhan outbreak that occurred at the start of the COVID-19 pandemic took place a year after the event. The World Health Organisation was obliged to understand what lessons could be learned and organised an international team of experts in virology, epidemiology and associated disciplines. Insertion of the expert team into China occurred against a background of political posturing at the highest level and led to low expectations of a definitive result. Microbial forensic results are time-, location- and procedure-specific, thus it is hard to reconstruct a series of microbial events after the fact. Forensic examination of laboratory records is another step away from actual microbial events, though they may form a part of the body of forensic evidence used to assemble an argument for cause and effect. Unfortunately, the passage of time has seen a shift from learning lessons about disease origins to apportioning blame. The second iteration of the WHO investigation team, known as the Specialist Advisory Group on Origins (SAGO) reflects the unanswered questions from WHO's initial field investigation of the possible origins of the COVID pandemic and doubts raised by additional information that came to light in the intervening period[1]. Specialist groups such as WHO's SAGO have a political dimension but must be allowed to do their work without fear or favour.

1. WHO statement on advancing the next series of studies to find the origins of SARS-CoV-2. https://www.who.int/news/item/12-08-2021-who-statement-on-advancing-the-next-series-of-studies-to-find-the-origins-of-sars-cov-2

CHAPTER 3

The pandemic dividend

One of the broad consequences of the social disruption caused by the COVID-19 pandemic has been a loss of trust in authority (F) in addition to the wider community outside close family, friends and colleagues. This has many manifestations which are beyond the scope of this review. Nevertheless, a comprehensive loss of trust in public sector administration, national polity and an international rule-based system have implications for immediate and future biosecurity provisions.

Full restoration of socio-political norms operating at the start of the pandemic will take a long time. The impatience of some leaders will not accelerate the return of business as usual if neighbouring countries remain locked into cycles of COVID-generated disruption. SARS-CoV-2's capacity for continuing evolution around vaccine countermeasures will divert valuable biosecurity resources from other pressing needs, including newly emerging threats such as the mosquito-borne Japanese encephalitis recently detected in eastern Australia.

For this reason, the initial organisational agility shown in early 2020 needs to be given the space to adapt to new threats. As in 2020, a swift response will depend on interpersonal relationships that span boundaries between professional disciplines, institutions, nations and time zones. Restoration of trust in broad networks is a work in progress, given some of the sharp words traded over the root cause of the pandemic, poorly explained differences in social restrictions and unequal access to COVID-19 vaccines.

Some of the regional Indo-Pacific COVID dividend has been heightened collaboration between institutions in different nations borne out of shared professional challenges, for example collaboration between Australian and Malaysian subject matter experts on the emergence of Nipah virus in Malaysia, and with Sri Lanka to set up a national melioidosis surveillance program. Some pre-pandemic alliances and professional collaborations have fallen victim to COVID-19 disruption, but increased online collaboration demonstrates that it is possible to work on international projects with less long-distance travel by the participants.

Loss of funding, staff and infrastructure and diversion to COVID-19 duties are comprehensible reasons why there will be some absences from the future biosecurity cast list. The already low numbers of specialist public health virologists, most of whom are at the senior end of their careers, will dwindle further once the pandemic is truly over. Their critical contribution through 2020 and 2021 must be replaced with a younger generation of specialists to ensure the insight public health authorities have relied on can be provided without fear or favour, including a systematic analysis of the fundamental root cause(s) of the initial Wuhan outbreak.

Recognising the international sensitivities surrounding the origins of the pandemic is one thing. However, collegial cooperation to uncover its main drivers so that there will be no SARS-CoV-3 pandemic is still firmly wedged in the 'too hard basket'. The regional branches of the World Health Organisation and its Global Outbreak and Response Network (GOARN) have a lot of homework to do in order to improve response time, reach, sustainment and inter-operability. Confidence in the peak international health agency was dealt a body blow by the pandemic. It remains to be seen whether the WHO is able to adapt to the emerging post-pandemic biosecurity landscape.

Significant progress in regional and extra-regional alliances occurred during the pandemic, presenting opportunities for strengthened co-operative biosecurity collaboration in the post-pandemic future. The historic informal cooperative network that supported the Indo-Pacific since the colonial era needs to grow out of its reliance on distant external partners and replace this with a regional biosecurity network of geographic neighbours and like-minded external supporters.

Coming at a time of heightened military activity in the South China Sea and open warfare outside the Indo-Pacific region in Europe, it is evident that biosecurity has multiple intersections with other forms of security. The restoration of international trade and travel at pre-pandemic levels will increase the risk of trade and travel-related biothreats such as antibiotic-resistant infections. Further increase in trade and travel through geo-economic initiatives in the region such as China's Belt and Road program will add volume, speed and complexity to biothreat movements through the region unless the corresponding countermeasures can be brought to counter future threats.

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Wearing protective masks became commonplace in COVID-impacted communities. Mandated mask-wearing was controversial but was part of a package of non-pharmaceutical interventions that reduced COVID case numbers, disease severity and mortality.

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Finally, not all emerging technology is either neutral or defensive. Some have overt offensive intent, for example long-distance projectiles with biological or toxin payload capability. The disregard shown by the Putin administration for Western democratic norms, an international rules-based consensus and the operation of international law in its prosecution of the war with Ukraine raises a clear and present biosecurity threat. As demonstrated recently through the use of the Novichok nerve agent on multiple occasions, an internationally agreed ban is unlikely to deter Russian use either on the battlefield or against a civilian population. Detection and characterisation of chemical warfare agents requires specialist equipment and immediately signals criminal intent. Biological weapon agents, on the other hand, take longer to detect and characterise, and may have an element of deniability if the disease they cause is endemic in the location where they are used. Ukraine's public health has already suffered disruptive influence from Russia since annexation of the Crimea. NATO, the WHO and other stakeholders will no doubt be watching the emerging biothreats closely.

CONCLUSIONS

The COVID-19 pandemic has exposed critical biosecurity vulnerabilities in much of the Indo-Pacific region, including limited formal collaboration and scattered local capabilities that rely on individual personalities and their institutions. The investigative and surveillance legacy of the colonial era was obsolete long before the COVID-19 pandemic. Disruption of biotechnology supply chains, patchy collaborative networks and differing disease control strategies hindered early pandemic control attempts. The restoration of regional travel and cross-border movement and the resumption of professional business provide an opportunity to regain trust in regional partners. The future biosecurity of the Indo-Pacific region relies on key opinion leaders recognising the value of close collaboration to counter common threats.

Previous attempts at pandemic preparedness in the Indo-Pacific have been patchy, top-down initiatives that lacked commitment to sustainment or long-term resourcing. The foundations of the region's biosecurity must be built deeper, covering both biothreat crisis and consequence management, if it is to withstand the disruptive effects of successive external threats. Technology-enabled threats demand technology-enhanced surveillance and a real-time actionable data stream to drive a targeted, just-in-time response. No country in the Indo-Pacific region has a central public health agency like the US Centers for Disease Control and Prevention. Most rely on a pragmatic assembly of public health agencies, academic and hospital laboratories, research institutes and industry partners. For middle powers such as Australia and its regional neighbours, the response to an emerging pandemic threat requires swift acceleration of scientific, technical, industrial and logistic capacity, which may not be available when surrounding nations face the same threat. The national cost of onshoring these capabilities to extend state-based public health will be much less than the impact of inaction or indecision on COVID 2.01. A sharing of these enhanced biopreparedness costs could be achieved through interagency, inter-state and international cooperation, managed under a common governance structure. In short, our future biosecurity needs professionalising.

As Louis Pasteur once said: "Science knows no country, because knowledge belongs to humanity, and is the torch which illuminates the world. Science is the highest personification of the nation because that nation will remain the first which carries the furthest the works of thought and intelligence."

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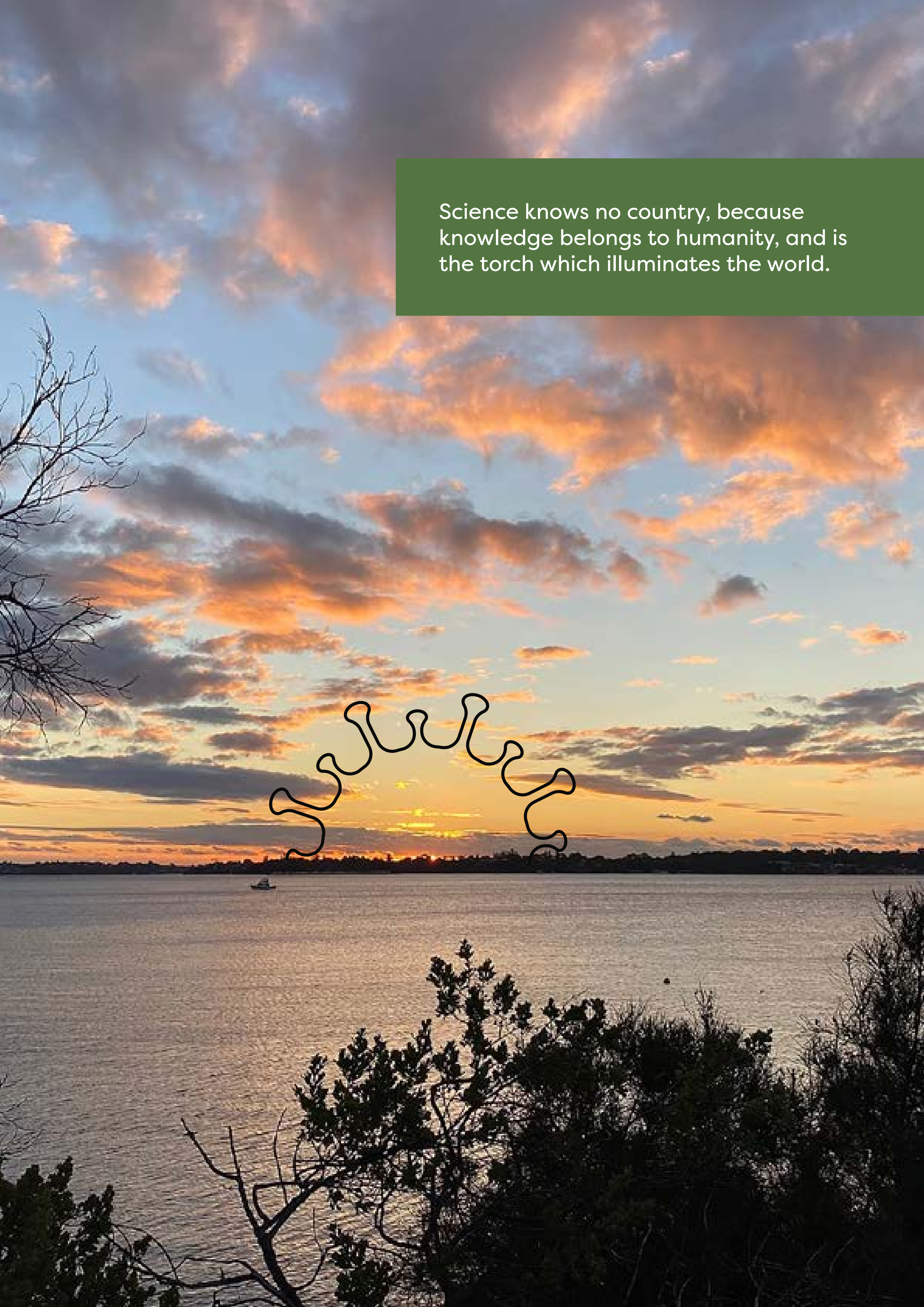
As COVID sinks below the horizon, we need to reflect on how much better we are prepared for the next pandemic.



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