Introduction

I was excited to see Australia announce the creation of a Centre for Disease Control. COVID-19 made it clear that Australia needs an institution of this kind. I'm also glad that Australia has commissioned this Inquiry, including to inform the priorities of the CDC.

There's a long-standing public health adage that "prevention is better than a cure". The same logic applies to pandemics. Pike et al in "The Origin and Prevention of Pandemics" show that the "wait-and-respond approach is not sufficient and that the development of systems to prevent pandemics *before* they are established should be considered imperative to human health." Given the huge human and economic costs of pandemics – and that pandemics worse than COVID-19 are possible – prevention should be our top priority.

I think this insight should be foundational to the direction of this Inquiry.

I know that each Australian jurisdiction invests heavily in hazard reduction for other natural disasters and are increasing their efforts because of climate change. But I'm not aware of any similar investment in reducing the likelihood of pandemics, even though the risk to the average Australian seems much higher.

My submission focuses on a select few issues, but my overall view is that pandemic prevention should be a key priority of the CDC and that our institutions and leaders should never concede that pandemics are inevitable.

Engineered Pandemics

Nature can produce pathogens that are extremely infectious like measles, with an estimated R0 of 15-20. Nature can also produce pathogens that are extremely fatal like rabies, which has an almost 100% death rate. Nature, however, is not known to produce pathogens that have both high transmissibility and high mortality.

Humans, driven by various motivations, could be on the verge of creating pathogens with both these features – risking pandemics much worse than COVID-19. The convergence of open science leading to the publication of dangerous knowledge, democratisation of synthetic biology, and AI-assisted research might mean that a small group of nefarious actors could cause catastrophic harm.

Preventing the next pandemic requires making sure that highly skilled bad actors never have the capability to engineer a novel pathogen. However, a variety of trends are making this a realistic possibility. Open science norms – while typically essential to modern science – sometimes allow the publication of dangerous material. While the scientists who published the genomic sequences of the smallpox virus perhaps didn't foresee a future where the synthesised DNA was readily available, that information cannot be "unpublished". I recommend that the

inquiry read “Information Hazards in Biotechnology” (2018) by Lewis et al for a deeper understanding of this risk and more examples, including Mousepox and Botulinum toxin H.

Similarly, AI models are on the cusp of being able to provide substantial assistance to people doing research and filling tacit knowledge gaps. Again, if action is not taken and models with these capabilities become widely available, we may not be able to “unpublish” them. Dario Amodei, CEO of Anthropic, informed the US Senate Judiciary Subcommittee on Privacy, Technology and the Law that *“a straightforward extrapolation of today’s systems to those we expect to see in 2 to 3 years suggests a substantial risk that AI systems will be able to fill in all the missing pieces, enabling many more actors to carry out large-scale biological attacks”*, and the Committee Chair, Senator Blumenthal, stated *“It may be shorter because the kinds of pace of development is not only stunningly fast, it is also accelerated at a stunning pace”*.[1]

Overall, I think the Inquiry should task the new CDC with responsibility for tracking the risk that a bad actor could create a pathogen with pandemic potential, and ensuring that safeguards remain one step ahead of that risk.

Biological Laboratory Safety Standards

Public commentary has focused on the possible origins of COVID-19, including whether it was a “lab leak”. Regardless of the true origin of COVID-19 specifically, I’ve been shocked to learn about the high rate of safety incidents at labs handling dangerous pathogens. A publication by Manheim and Lewis found that from 1975-2016 there were 71 reported high-risk human-caused pathogen exposure events – as well as evidence of underreporting.[2] An anonymous survey on biosecurity and accidents in Belgium reported almost 100 laboratory-acquired infections in a 5 year study period.[3]

Gopal et al in “Securing Civilisation Against Catastrophic Pandemics” use a range of tools to estimate the likelihood of different future pandemic scenarios. In their estimates of ‘worst case’ pandemics, they conclude that dangerous pathogens leaking from labs are currently the most likely cause. This isn’t surprising, given that the original SARS virus escaped from labs on at least 3 occasions in the early 2000s and the 1977 flu pandemic was caused by a lab leak. This issue addresses many of the Inquiry’s terms of reference, including the role of the Commonwealth as a regulator in this space.

One of the factors Gopal et al consider in estimating the likelihood of a pandemic emerging from a lab leak is the annual accidental infection rates of laboratories. Using data from a report by the Center for Arms Control and Nonproliferation, labs registered with the Federal Select Agent Program have accidental infections at a rate of 0.246% per laboratory per year and NIH-funded BSL-3 and BSL-4 laboratories have accidental infections at a rate of 1.6% per laboratory per year.

While both of these figures seem alarmingly high, Gopal et al argue that the fact that the more tightly regulated Select Agent laboratories exhibited a 6.5-fold lower accidental infection rate strongly suggests that tighter regulations and more regular inspections improve safety.

Given pandemics can cost millions of lives and trillions of dollars, it seems clear that safety standards (or adherence to standards) fall far short of what is appropriate. While I’m firmly in

favour of science, and think that science is a force for good in fighting pandemics, it has to be done responsibly.

As an outsider, there is little transparency about how physical containment facilities in Australia are regulated. The Office of the Gene Technology Regulator seems to focus mostly on GMOs and provides little information about its functions regarding physical containment facilities.

To the extent that information is available, OGTR's 2022-23 annual report is proud that it certified a record 132 physical containment facilities last year, meaning that there are now 1,874 "high-level" facilities operating in Australia. However it also reports that it only conducted 49 inspections in the same period, and previous annual reports show that it has only conducted a single inspection of a PC4 facility in the last 3 reporting years combined.

In addition to seeming shortcomings in oversight, the guidelines themselves are troubling. The rules for PC4 facilities were last updated in 2007 and refer to standards like AS1324.1 on air filters and AS/NZS 2243.3 on lab safety, which don't appear to have been updated since 2001 and 2002 respectively. AS1324.1 specifically has been criticised by the HVAC industry for being based on inaccurate research from the 1950s and has now been superseded by ISO 16890.

While this is a concerning situation on multiple fronts, it's not necessarily a criticism of OGTR. OGTR only has 51 employees and has wide-ranging regulatory functions apart from these topics.

Overall, this snapshot paints a grim picture of the state of regulation in Australia, and one that I think falls far short of public expectations about how seriously these issues would be taken. Before reading into this, I would have guessed that PC4 facilities comply with cutting-edge global standards that account for emerging technology, and would each be inspected several times per year.

I think that this Inquiry should recommend a thorough review of biosafety – including the suitability of requirements, degree of adherence, and adequacy of oversight – for all research that involves human or animal pathogens. The review should include a risk assessment that takes into account the potentially catastrophic global consequences of errors, and ensures that our approach to mitigation is proportionate to that risk.

Conclusion

I think pandemics are one of the most important issues of our time, and expert assessments that the risk of pandemics is increasing are alarming. I think this inquiry should carefully consider how future pandemics could start and ensure it makes specific recommendations to reduce their likelihood. This should include the known mechanisms that have been with humans since time immemorial, such as zoonoses, as well as more recent risks, such as lab leaks, and emerging threats, such as engineered pathogens.

[1]https://medium.com/@daniel_eth/ai-x-risk-at-senate-hearing-7104f371ca0b
[2]https://pubmed.ncbi.nlm.nih.gov/35903214/
[3]https://www.biosafety.be/sites/default/files/2015_willemarck_lai_report_belgium_2007_2012_final.pdf