As a quick introduction, I'm Justin, a researcher and former public servant with a strong interest in protecting Australia's economic stability and national security. I have tertiary education and/or research experience in public health, molecular biology and artificial intelligence. I'm also a resident of Melbourne, and was directly affected by various mishaps during the COVID-19 response (e.g. outbreaks from quarantine facilities).

"*As the Ebola and Zika crises showed, managing pandemics is a global responsibility, but too much planning is still national, and little attention is paid to worst-case scenarios.*"

- A 2017 quote from Oxford researcher Sebastian Farquar

I've long been concerned by such calls from experts for Governments to be more proactive in addressing risks from pandemics. I believe we have been relatively lucky in avoiding catastrophic pandemics - as damaging as COVID-19 turned out to be, it is nevertheless still considered to have been a "dress-rehearsal" for more serious pandemics[1].

To illustrate this point, the recent pandemic was mild enough that civilian populations were ordered to stay home, and threatened with punishments for not doing so. As experts have warned[2], a more serious pandemic would be characterised by essential workers refusing to leave their homes, causing a widespread breakdown of supply chains and essential services - these are the scenarios that the Inquiry must be cognisant of.

There are tangible of examples of how this might arise: the H5N1 avian influenza is over 50% lethal in humans[3], and mutations that increase its transmissibility (which have been shown in laboratory settings[4]) would have grave consequences for public safety. Another horror-story example is the naturally occurring Calicivirus in rabbits, with a fatality rate of 90% in adults, and the ability to spread extremely easily through populations, especially because of lower death rates in younger rabbits.

I've often heard professionals in the biotechnology industry joke that they could bring civilisation to its knees by engineering a super-virus of this kind and releasing it at an airport. The fact that this hasn't occurred yet is pure luck; the scientifically advanced terrorist group *Aum Shinrikyo,* active in the 80's and 90's, narrowly missed out on having access to the technology necessary to do this. Their best option at the time was to release anthrax aerosols over a large city, or capture a live sample of ebola from Africa - both of which they invested resources into doing.

As an Australian citizen, the risk from extreme pandemics is the **#1 factor** that makes me fear for the safety of myself and of loved ones. It's also the reason I am very excited about the move to establish the new CDC, and this focus of this inquiry on preventing the next pandemic. Accordingly, there are 3 key priorities that I'd like to raise for consideration:

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[1] *Early Thoughts on the Pandemic* (2020). Sam Harris and Amesh Adalja
[2] Gopal et al. *Securing Civilisation Against Catastrophic Pandemics*
[3] *Situation Report: Highly Pathogenic Avian Influenza A(H5N1)* (2023). National Emerging Special Pathogens Training and Education Center
[4] *Fouchier study reveals changes enabling airborne spread of H5N1.* (2012) University of Minnesota

Priority 1: Detection of novel pathogens with pandemic potential

The CDC should prioritise research into the most scalable and targeted methods for assessing novel pathogens in circulation, including methods such metagenomics (both clinical and wastewater), CRISPR-based diagnostics, and improvements to and multiplexing of PCR and LAMP. In particular, monitoring the wastewater of international arrival aeroplanes is considered to be a low-hanging opportunity for detecting novel pathogens.

The inquiry should also take into consideration the analysis undertaken by the Geneva Centre for Security Policy, titled "*Securing Civilisation Against Catastrophic Pandemics*" [5]. The authors highlight the realistic dangers from "stealth pandemics" - those arising from highly virulent pathogens whose worst effects become present after a significant delay. For any advanced terrorist group that wishes to inflict atrocious casualties on an enemy, a pathogen of this kind is the best option.

Currently, there is no systematic process for detecting this kind of threat; with the cost of biotechnology tools decreasing rapidly, we need to begin deploying these capabilities defensively in order to counteract potential offensive uses. Australian biosecurity researcher Chelsea Liang outlined some of the relevant policy considerations for implementing this kind of a monitoring program[6].

It goes without saying that these early detection systems wouldn't be exclusively useful for engineered pandemics - they would also assist in responding to other sources of pandemics, such a zoonotic transmission or laboratory leaks. Relatively small-scale programs were shown to be effective in the later stages of the COVID-pandemic[7].

Priority 2: Development and deployment of far-UVC light for indoor quality

I'm sure the Inquiry will already be aware of the rationale behind far-UVC light (it's ability to inactivate airborne pathogens but leave humans unharmed) - as a formality I will provide a relevant citation if further background reading is desirable[8].

Suffice to say, there is a significant opportunity to reduce air-born transmission of pathogens by mandating the deployment of far-UVC lighting in high-risk indoor settings. With current technology, this isn't yet cost-effective, but with additional R&D investment this may become our best line of defence against the spread of infectious diseases.

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[5] https://www.gcsp.ch/publications/securing-civilisation-against-catastrophic-pandemics

[6] Managing the Transition to Widespread Metagenomic Monitoring: Policy Considerations for Future Biosurveillance, Health Security. (2023) Chelsea Liang et al.

[7] Wegryzyn et al (2022) Early Detection of Severe Acute Respiratory Syndrome Coronavirus 2 Variants Using Traveler-based Genomic Surveillance at 4 US Airports, September 2021–January 2022, Clinical Infectious Diseases

[8] Far-UVC (222 nm) efficiently inactivates an airborne pathogen in a room-sized chamber. (2022) Eadie et al.

As a matter of priority, the Australian Government should be investigating ways to support R&D in far-UVC-lighting, and the CDC should begin drafting a strategy for it being rolled-iout across Australia in anticipation of it becoming a scalable solution.

- As pointed out in the Terms of Reference, at-risk populations are an important consideration during pandemics, and these devices should be installed ASAP in settings as hospitals and nursing homes.
- In the medium term, there will be benefits to economic security by installing them in transmission sites such as public transport, schools, and airports.
- As a long-term strategy, building codes should incorporate requirements for installation of far UVC lighting; Governments should also incentivise workplaces to install them by reimbursing a proportion of the costs (this is relevant to the ToR point of "Support for industry and businesses").

Priority 3: Take measures to protect critical infrastructure workers during pandemics

The Inquiry should familiarise itself with a paper called "Electric Power Grids Under High-Absenteeism Pandemics: History, Context, Response, and Opportunities" (Wormuth et al.), which explains how the energy sector is the critical failure-point for interdependent essential services, such as water systems, communication networks, transportation systems and health services[9].

The paper points out that COVID-19 was unlike many other historic pandemics because a majority of deaths occurred in people over 65, while the majority of employees essential to the continued operation of the power grid are under 65. An extreme pandemic that affects working-age civilians could precipitate cascading failures of critical infrastructure; this risk is a feature of our modern infrastructure, which is highly optimised for efficiency and therefore extremely brittle. For the inquiry to succeed in addressing Terms of Reference one, two and six, it must secure Australia against this challenge.

In terms of solutions, both Wormuth et al. and Gopal et al. advise that power generators, transmission providers and distribution providers should have the capability to provide high-quality PPE to their workers during a crisis. Experts recommend that powered air-purifying respirators with HEPA filters should be required - asking critical infrastructure workers to leave their homes during a >20% fatality pandemic with an inferior level of protection would be wishful thinking.

Conclusion:

I believe that if this Inquiry makes the right recommendations, Australia will be a safer, more prosperous place for generations to come.

Investments that improve indoor air quality will reduce the baseline level of transmission, giving society a better chance to "keep the lights on" during mild pandemics such as COVID. Early detection will allow us to respond more quickly and with greater confidence; and next-

[9] Electric Power Grids Under High-Absenteeism Pandemics: History, Context, Response, and Opportunities

generation PPE in critical infrastructure will ensure that even in the worst case scenarios, Australia will be able to sustain itself and bounce back.