WITNESS STATEMENT OF PROFESSOR LINDSAY GRAYSON

I, Professor Lindsay Grayson MB BS (Hons), MD, MSc, FRACP, FAFPHM, FRCP, FRCP (Edin), FIDSA. Director of the Infectious Disease Department, Austin Hospital of 145 Studley Rd, Heidelberg, Victoria, say as follows:

1 I have been asked by lawyers assisting the Board of Inquiry into Victoria's Hotel Quarantine Program to provide a statement concerning the SARS-CoV-2 virus.

2 I make this statement based on:

(a) my years of experience as a clinical physician specialising in infectious diseases and infection control;

(b) my understanding of currently available scientific and medical information, including research and clinical information in relation to the virus; and

(c) my first-hand experience in dealing with patients, including as Director of the Infectious Diseases Department at a large Victorian metropolitan public hospital, which is actively engaged in responding to the pandemic.

BACKGROUND

Qualifications and experience

3 I am a Professor of Infectious Diseases in the Department of Infectious Disease and the Department of Microbiology at Austin Health.

4 I hold the following qualifications:

(a) Fellow, Infectious Diseases Society of America (FIDSA), USA (2012)

(b) Fellowship of the Royal College of Physicians, UK (2009)

(c) Fellowship of the Royal College of Physicians of Edinburgh, UK (2008)

(d) Master of Science (MSc) in Clinical Epidemiology & Clinical Effectiveness, Harvard School of Public Health, Harvard Medical School, Boston, USA (1997)

(e) Doctor of Medicine Degree (M.D.), Monash University (1994)

(f) Fellowship of the Australian Faculty of Public Health Medicine (1990)

(g) Fellowship of the Royal Australasian College of Physicians (1988)

(h) Bachelor of Medicine, Bachelor of Surgery (Honours), Monash University (1979)

5 I currently hold the following positions:

(a) Professor of Medicine, Faculty of Medicine, Dentistry and Health Sciences at the University of Melbourne, Melbourne;

(b) Professor (Honorary), Department of Epidemiology and Preventive Medicine at Monash University, Melbourne;

(c) Director of Hand Hygiene Australia, based at Austin Health;

(d) Infectious Diseases Physician at Bendigo Health & Mallee-Loddon Region, Bendigo;

6 I hold the following editorial positions:

(a) Reviewer at the *New England Journal of Medicine*;

(b) Reviewer at the journal *Lancet Infectious Diseases*;

(c) Reviewer at the journal *Emerging Infectious Diseases*;

(d) Reviewer at the journal *Clinical Infectious Diseases*;

(e) Reviewer at the *Medical Journal of Australia*;

7 Attached to this statement and marked "**LG-1**" is a copy of my Curriculum Vitae.

Current role and responsibilities

8 I am Director of Infectious Diseases & Microbiology at Austin Health, and Director of Hand Hygiene Australia. The Infectious Diseases (**ID**) Department, which includes responsibility for infection control, provides extensive inpatient and outpatient care to a diverse local population, in addition to a number of complex services including liver, intestinal, renal and bone marrow transplantation, HIV, TB, spinal injury and intensive care. The Department is responsible for organising and overseeing the hospital's COVID-19 response as well as key infection control initiatives, with key staff holding the roles of Director and Deputy Director of COVID-19 Services, and the Director of Infection Control. A large number of ID staff are involved in the direct care of patients with suspected or proven COVID-19. The Microbiology Department is tightly linked to the hospital's molecular biology testing laboratory which provides a large COVID-19 testing service. A number of key staff are cross-appointed with the Microbiological Diagnostic Unit (MDU) and the Doherty Institute. Among a wide range of research activities, the ID Department has developed an expertise in infection control initiatives related to multi-resistant pathogens ("superbugs") and the integration of genomics into clinical practice – such as improved early detection of disease outbreaks, improved targeting of antimicrobial use and the design of effective infection control interventions. Hand Hygiene Australia

(which is based at Austin Health) has, for the past decade, been responsible for the Australian National Hand Hygiene Initiative which aims to improve hand hygiene among healthcare workers through the increased use of alcohol-based hand rub in all Australian hospitals to reduce the risk of healthcare-associated infections. This education and auditing system is now embedded in the national hospital accreditation system in which a specified minimum level of performance is a mandatory requirement.

THE NATURE OF COVID-19

A basic explanation of the SARS-CoV-2 virus, how it infects the body and the clinical symptoms of the virus

9 SARS-CoV-2 is a coronavirus. Coronaviruses are a family of viruses which are thought to only affect mammals.

10 Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is the strain of coronavirus that causes coronavirus disease 2019 (COVID-19).

11 The SARS-CoV-2 virus enters the body through mucous membranes (including the conjunctiva of the eyes, the membranes of the nose and the mouth) and via the lining of the lungs.

12 For COVID-19 illness to occur, a person must be exposed to a sufficient amount of the SARS-CoV-2 virus (the amount of virus is known as a "viral load", a term which is explained further at paragraph 17 below).

13 In humans,[1] the virus primarily attaches to the epithelial lining of the respiratory tract, most significantly to the epithelial lining of the lungs. Once it has invaded the epithelial cells, it then rapidly multiplies and then may spread further throughout the body. Clinical symptoms are mainly of respiratory illness, which occur – in effect – as a result not only of the virus itself but also as a function of the body's immune response to it.

14 The most common symptoms of COVID-19 are fever, dry cough, sore throat, tiredness and shortness of breath. Loss of smell and taste (together) appear to be a pathognomonic symptom, meaning that these symptoms are so characteristic of the disease that they can be used to highly suggest the diagnosis.

15 If a person has an adequate immune response, they appear (statistically) to be less likely to become seriously unwell than people with a weakened immune system (e.g. due to aging, an underlying medical condition or some medical treatments). Suppressing the immune system (e.g. through

[1] SARS-CoV-2 also affects other mammals including cats and pigs. In pigs, it affects the intestinal lining and causes diarrhoea, which has been an ongoing issue for the pork industry.

corticosteroid treatment) may reduce a patient's symptoms, as it can reduce the immune response. However, the immune system is ultimately responsible for eliminating the virus. This has two important consequences. First, immune-suppressant treatments, whilst potentially assisting in reducing symptoms, may delay or impede the body's own natural defences in eliminating the virus responsible for those symptoms. Secondly, those with weakened immune systems are at higher risk of more serious health consequences if they are infected.

16 Observations suggest that COVID-19 also tends to affect different age groups differently. In broad general terms:

(a) Children are more likely to be asymptomatic or have only mild symptoms;

(b) Up to about a third of younger people may be asymptomatic or only trivially symptomatic; and

(c) Older people, especially those with certain co-morbidities (such as hypertension, cardiac disease and diabetes) appear to experience symptoms rapidly.

Viral load and viral shedding

17 Viral load is a measure of the amount of virus particles in a given sample – for example it may refer to the amount of virus present in a person's tissues or bodily fluids (e.g. respiratory droplets), or the amount a virus to which a person is exposed.

18 Viral shedding occurs when a person expels viral particles from their body.

19 The term "super spreaders" refers to the concept that certain people may be more likely to transmit the virus to others (for example, because they have a higher viral load and may therefore be likely to be more infectious, or because they are asymptomatic and are therefore less likely to suspect they have COVID-19 and need to self-isolate). Thus, super-spreading occurs when a single patient infects a disproportionate number of contacts. For instance, in the SARS-CoV outbreak in 2003, the index patient of the Hong Kong epidemic was associated with at least 125 secondary cases (Riley *et al.* Transmission dynamics of the etiological agent of SARS in Hong Kong: impact of public health interventions. Science. 2003 Jun 20; 300(5627):1961-6.). For COVID-19, some recent overseas studies have suggested that possibly 10-20 percent of COVID-infected patients may be responsible for 80 percent of all cases.

Lifecycle of the virus, including incubation periods, recovery times and timeframes in which a person is infectious

20 Currently, it seems likely that most people who have the virus may be infectious for up to 48 hours before they show any symptoms. This timeframe is variable between different people – some may be infectious for a longer period before symptom onset, others for a shorter period. However,

48 hours is currently considered a reasonable average timeframe, and is the period on which most focus is placed, when it comes to ascertaining who else may be infected as a result of contact with a person who is showing symptoms. Similar to many other viral infections, most infected people's viral load is thought to be at its maximum in the period between 24 and 48 hours prior to developing symptoms and the early period of symptom onset.

21 If a person is asymptomatic, or has not yet begun to experience symptoms, there is a potential risk that they will transmit the virus to others unknowingly. This may be because those people tend to take fewer precautions (in not knowing they are infected) and may interact more freely with others.

22 People who show symptoms continue to be infectious, and remain so, until their viral load decreases. While a patient is symptomatic from COVID-19 (not a subsequent complication or another cause), they are usually considered infectious, although some patients can continue to shed virus in sufficient quantities to be considered infectious after symptom resolution. The time to symptom resolution appears to vary with age – for instance, younger patients generally sustain a shorter period of illness than older patients. In general, most symptomatic COVID-19 patients resolve their symptoms in approximately 10-14 days and are considered likely to be non-infectious at the end of that time.

23 Generally, the lifecycle of the virus is that:

(a) The virus enters the body through the epithelial lining of the respiratory tract or via mucous membranes (nose, throat or conjunctiva);

(b) The viral load increases as the virus multiplies and spreads throughout the body, including the gut;

(c) The patient may display signs of infection including one or more of: cough, fever, sore throat, headache, shortness of breath, fatigue and loss of sense of smell and/or taste;

(d) There is a general immune system response to control and eliminate the virus (which, in some cases, may also cause or exacerbate symptoms);

(e) The immune system starts to develop a specific response, in the form of generating antibodies and white blood cell (mostly lymphocyte) immune response which are specific for the virus. Although not entirely certain for COVID-19, these antibodies and lymphocyte responses are thought to be key to eliminating the virus, in addition to the body's general response;

(f) Symptoms decrease as the body's immune system effectively decreases the person's viral load, ideally, eliminating the virus entirely;

(g) The patient recovers, although some patients experience persisting sequelae.

24 Although statistics vary from country to country, present data suggest that, for every 100 Australians who test positive for the virus, up to 20% may require admission to hospital, up to 10% may require intensive care support, and between 1.4 to 3.4% may die. It is currently not possible to say what percentage of the Victorian population are likely to be infectious.

25 Those who die from the COVID-19 disease generally have a decreased ability to effectively reduce and eliminate the virus due to a compromised or weakened immune system (including that associated with natural aging) or because the physiological effects caused by the virus, and the immune response triggered, become so significant that key bodily organs (some of which may already have been compromised prior to acquiring COVID-19) begin to fail. If the body is unable to recover and the disease, or its complications (e.g. routine complications associated with long-term intensive care support), overwhelm the patient, the patient dies.

The body's immune response

26 An immune response is triggered when there is a foreign substance in the body. The body initially launches a general immune response in the form of a broad, non-specific, response. If the body has experienced the foreign particle in the past it may have an "acquired immunity" in the form of specific antibodies and other immune defence mechanisms.

27 Most typically, antibodies interact with proteins on the surface of the foreign particles, known as antigens. Antigens tend to be very specific to the type of foreign substance detected. In the case of viruses (as with other foreign substances), antibodies are specific to the particular strain of virus. Changes to a virus over time (e.g. as seen commonly with influenza) may result in changes to the surface-protein antigens, and thus a new 'strain' requires a new exposure for the body to have an accurate ("specific") acquired immunity to that new strain. This is because the antigen is different to the earlier strain and therefore the body needs to recognise that new antigen and develop new antibodies and other key immune mechanisms.

28 Once the body recognises an antigen (either as new or because it has already been exposed to it in the past) it triggers the production of antibodies and enlists the assistance of key white blood cells (including T and B lymphocyte cells) to fight the infection and develop immunity.

29 Antibodies remain in the body so as to enable it to detect the antigen and eliminate any future infections more readily. That is why the body is generally more effective in eliminating foreign particles to which it has been exposed in the past (either via infection or vaccination); it already has the "coding" for antibody production in its immune memory, compared with the situation of an initial or first-time infection. For an initial or first-time infection, the immune system must first detect, then identify, and then produce the specific antibodies and other specific immune mechanisms to deal with that substance. It is this principle upon which immunisation is based.

30 Immunisations work by introducing an antigen into the body in a way that will not cause a person to become too unwell but will enable the body to identify that specific antigen and create antibodies and other specific immune mechanisms to deal with it in the future. There are varying timeframes for which this immunity lasts.

31 In terms of developing a vaccine for SARS-CoV-2, current data seem to indicate that some of the vaccines in development may only be effective (in terms of an adequate antibody response) for a limited period of some months, but this varies with the nature of the candidate vaccine, the number of "booster" doses given and the adequacy of the recipient's immune system to respond to the vaccine. After that time, the immune system's "memory" wanes, meaning that the SARS-CoV-2-specific antibodies may not remain in the body at adequate immediate concentrations beyond that time and need time either to recover (via immune "memory" mechanisms) or via a further "booster" vaccination(s).

32 There have been a small number of instances where people appear to have been infected with SARS-CoV-2 more than once, but they are generally rare. Currently, detailed data appear incomplete – for instance, few studies have conducted adequate genomic testing in such cases to determine whether the genetic "fingerprint" of the strain (and its antigens) contracted on the first occasion was the same as that contracted on subsequent occasions. Part of the challenge in developing a vaccine for SARS-CoV-2 is in creating a vaccine which is effective for the relevant strain and any subsequent variants and provides immunity for an extended period of time. For non-human strains of coronavirus, such as those in pigs, vaccine development has been fraught.

TRANSMISSION OF THE VIRUS

The concept of R_0

33 R_0 is the average number of people who are likely to contract a contagious disease, from one other person with that disease, within a sample population. For a contagious disease to maintain spread throughout a population, R_0 needs to be greater than 1. An R_0 of 1 means that, in a community of people, one person is likely to infect only one other person. If that occurs, the virus remains in the community, as it is passed along a chain of infected persons. Where the R_0 is greater than 1, the infection is spreading.

34 Globally, SARS-CoV-2 is generally considered to have a potential R_0 value of approximately 2-3, although this can vary according to region, and health standards and controls. The current R_0 value for SARS-CoV-2 in Australia (as at 1 August 2020) is estimated to be about 1.05, while in Victoria where the pandemic is changing rapidly, and the current R_0 value is not publicly available.

35 By comparison, measles is considered to have an R_0 value of between 12 and 18, meaning that for every one person who has measles, an average of between 12 to 18 other (unvaccinated) people will be infected.

36 R_0 represents an average of likely transmission in the community and does not define an individual's actual potential for infecting others. Some individuals will have a rate of transmissibility that is higher than the average. The benefit of R_0 is that it provides a value by which to assess transmissibility in the broader community in order to guide decisions about what precautions and policies should be implemented.

37 An R_0 value is a function of both the infectivity of the virus, human behaviour, and subsequent interventions directed at stopping the spread of the virus (for example, behaviour modification or quarantine). The success, or otherwise, of interventions aimed at reducing transmission of the virus, can be monitored at a community level by assessment of the R_0 value. Precautions taken in the community are considered fundamental to reducing the R_0 value for SARS-CoV-2.

Modes of transmission

38 SARS-CoV-2 can be transmitted through droplets, aerosols and fomites. Therefore, transmission of the COVID-19 virus can occur directly by contact with infected people, or indirectly by contact with surfaces in the immediate environment or with objects used on or by the infected person (e.g., thermometers or other shared equipment).

39 SARS-CoV-2 may be transmitted when a person inhales droplets or particles that have been expelled by an infected person, either from coughing, sneezing, talking, singing or by breathing. In each case, the virus particle is suspended in the saliva or mucous particles (in droplet or aerosol form) which are ordinarily expelled by each of these actions.

40 **Respiratory droplets**, although small (typically >5-10 μm), may be visible by the naked eye under the right conditions (e.g. after sneezing). Airborne particles (typically ≤5 μm; also referred to as "droplet nuclei"), on the other hand, are usually invisible to the naked eye. Airborne transmission is defined as the spread of an infectious agent caused by the dissemination of droplet nuclei (aerosols) that remain infectious when suspended in air over long distances and time. Airborne particles can be generated by various medical procedures which cause aerosolisation (e.g. endotracheal intubation, bronchoscopy, open respiratory suctioning, turning a patient to the prone position, connecting and disconnecting a patient to a ventilator, or cardiopulmonary resuscitation). Airborne particles are sufficiently small that they can remain in the air for long periods and be transmitted to others over distances greater than 1 metre.

41 It is not necessary for a person to cough or sneeze in order to transmit SARS-CoV-2 (although coughing and sneezing do increase the likelihood of transmission). A person can spread the virus

by breathing, because the virus is present in the epithelial lining of the respiratory tract and can therefore be spread in exhaled respiratory droplets.

42 **Fomites** are surfaces or objects (including hands) which may become contaminated and serve as an intermediary vehicle for transmission. There are studies demonstrating that SARS-CoV-2 may survive on certain surfaces outside of the body (such as plastic, cardboard and stainless steel) for up to 72 hours. Were a person to come into contact with a surface containing droplets or aerosol which contain the virus, those particles and the virus could subsequently be transmitted to that person's body by exposure to their mucous membranes. For example, an infected person may cough on a door handle, which is then touched by another person. Should that second person then touch their mouth, there is transmission from the infected person to the second person.

43 Since SARS-CoV-2 may lead to intestinal infection, it can be detected in the faeces of infected people. Thus, it may theoretically be passed between humans through faecal spread, although to date, there have been no definite reports of faecal-oral transmission.

44 Although SARS-CoV-2 can be airborne, especially following aerosolisation procedures (see above), its potential for distant transmission (e.g. via an air conditioning system where air is partially recirculated such as in some large office buildings, hospitals or hotels) does not appear to be a dominant means of spread, based on current epidemiological studies. Nevertheless, there have been reliable reports suggesting probable airborne transmission in sites such as restaurants, during choir practice and fitness classes. In these latter events, short-range aerosol transmission, particularly in specific indoor locations, such as crowded and inadequately ventilated spaces over a prolonged period of time with infected persons, cannot be ruled out.

45 In my view, airborne transmission of SARS-CoV-2 is possible, but likely limited to certain physical contexts and not more generally. Were SARS-CoV-2 capable of substantial distant airborne transmission, we would have observed larger localised outbreaks than we have experienced, with larger clusters originating from such environments, especially where air is recirculated. We would expect to see an R_0 number which is much higher than what testing, surveillance and the number of known cases currently indicates.

Whether transmission is influenced by the seasons

46 It is unclear whether the virus spreads more readily in colder climates. The evidence is confounded. Potential reasons for increased spread in winter could be that people tend to spend more time indoors and may be closer to one another in general. In summer, people naturally tend to be more physically distanced from one another. There is no reliable data on whether seasonality itself (absent of human behaviour) affects the rate of transmission. Similarly, there has been concern that known outbreaks in abattoirs, may be related to the necessary cool working environment in

these facilities. However, these sites also often involve very close working conditions where social distancing is difficult or impossible.

COMPARISON BETWEEN COVID-19 AND OTHER PANDEMICS OR EPIDEMICS

Comparison of COVID-19 to other pandemics or epidemics, including SARS and MERS

47 There have been three major coronaviruses observed in human populations in the past two decades:

(a) **SARS (2003)**: Severe Acute Respiratory Syndrome (SARS) is a viral respiratory illness caused by a coronavirus: the SARS-associated coronavirus (SARS-CoV). It is considered less infectious than SARS-CoV-2, but its case mortality was substantially higher (about 15%) and there appeared to be a lower rate of asymptomatic carriage.

Because people who contracted SARS became very ill, it was relatively easier to track cases than with COVID-19. The virus had minimal effect in Australia, partly because the clinical symptoms were recognised quickly, and because Hong Kong and many other countries implemented a strong containment strategy.

During the SARS 2003 outbreak, there were six SARS cases reported to the World Health Organization as "probable" in Australia, with one of these considered as confirmed. All of these cases were travellers, with 5 cases quarantined in hospital. The sixth case, who was identified by SARS coronavirus serological testing overseas, was not hospitalised and was not detected or investigated by routine surveillance methods for SARS when in Australia because they arrived three weeks before the WHO alert. There was no evidence of transmission within the Australian community.

(b) **MERS (2012)**: Middle Eastern Respiratory Syndrome (MERS) is a viral respiratory disease caused by a novel coronavirus (MERS-CoV).

The 2012 outbreak was first identified in Saudi Arabia when the MERS-CoV was transmitted to humans (probably from dromedary camels, which appear to be the main reservoir). This outbreak was restricted to the Middle East and South Korea, partly because person-to-person transmission is relatively low (unless there is close contact) and as a result of active infection control measures in affected countries. Case mortality is about 35%.

Although MERS exhibited some asymptomatic carriage, person-to-person transmission was relatively low.

(c) **COVID-19 (2019)** appears to have originated in China and has spread globally, in part because the virus is highly infectious, it can be transmitted before the onset of symptoms,

and because those who are infectious may be entirely asymptomatic, or have only trivial symptoms.

48 The version of SARS-CoV-2 which is linked to the latest upsurge in the Victorian outbreak does not appear to be behaving any differently to previous iterations of the virus in Victoria. In my view, the current increase in the rate of cases is most likely linked to human behaviour, including factors such as who contracted the virus, the demographic of those who contracted the virus, the behaviour that led them to contract the virus, and their behaviour after contracting the virus.

FORESEEABILITY OF AN EPIDEMIC OR PANDEMIC SUCH AS COVID-19

49 The possibility of an epidemic or pandemic, particularly with a highly contagious viral infection, has been well recognised both in Victoria and nationally for many years. In particular, given the previous history of the "Spanish Flu" a century ago and more recent outbreaks of avian influenza (H5N1) and swine flu (H1N1), most pandemic planning has logically focused on strategies aimed at influenza – although the principles and operational framework of these plans are known to be very applicable to other respiratory viral infections, including COVID-19. The latest Federal plan ("Australian Health Management Plan for Pandemic Influenza") was published in August 2019, is 229 pages long and provides a detailed description of necessary containment measures, including quarantine. The latest Victorian pandemic plan ("Victorian action plan for influenza pandemic") was released in 2015, but a specific plan related to COVID-19 was released on 10 March 2020 ("COVID-19. Pandemic plan for the Victorian Health Sector v 1.0").

50 Thus, there was full awareness at both State and Federal level of the possibility of some form of pandemic, including the potential rarity, but likely reality, of a new pathogen entering the Australian community; the potential for this to spread and the means by which it would be likely to spread; and the importance of international surveillance and tight cooperation between Australia and key authorities such as the World Health Organization to identify and track any spread, should such an outbreak be identified.

PANDEMIC CONTAINMENT MEASURES

Quarantine

51 Quarantine is a public health measure, by which people who have or may have an infectious disease are isolated to prevent the spread of that disease. It is a method designed to ensure observation of those who may be infected (or who present a higher than usual probability of being infected), so as to prevent further spreading of a disease. "Quarantine" is different to "Isolation". "Isolation" separates people who are sick or potentially sick with a contagious disease from people who are not sick. Whereas "Quarantine" both separates and restricts the movement of people who

have been exposed to a contagious disease to see if they become sick, or in some cases, people who have already become sick.

52 The usual starting point for pandemic plans is for quarantine to occur in health environments (for example hospitals) with correct oversight from appropriately trained health professionals.

53 An efficacious and appropriate quarantine environment fundamentally starts from a position of assuming that all those who are in quarantine are potentially infected, until proven otherwise. The assumption for anyone monitoring a quarantined person should be that the person is infectious.

54 Basic quarantine principles demand a high degree of rigor in terms of spacial (and at times, physical barrier) separation of quarantined people and careful restriction of movement to avoid possible cross-contamination in shared spaces both indoors and outdoors. Indoor shared spaces such as hallways, meal and recreation rooms can be particularly problematic if there is a possibility of either droplet or localised airborne transmission. For outdoor areas, such as exercise zones, to meet quarantine requirements, there should be no possibility of contact (and therefore no possible cross-contamination) with other people who are in quarantine or with those who are not in quarantine. Quarantined people should not be permitted to interact with one-another since this could facilitate disease transmission. Even among people who are in quarantine and known to be infected, they should not be allowed to interact with other infected individuals unless it is absolutely certain that both individuals are known to have exactly the same strain of infection – even in such circumstances, extreme care should be taken to avoid unnecessary contact. Quarantine staff need to be particularly vigilant to ensure adherence to all these principles, but also to follow appropriate infection control guidelines (including the use of Personal Protective Equipment (**PPE**) to protect themselves from becoming infected from those people who are in quarantine and are developing active infection.

55 The rationale behind the 14-day quarantine period is that, for those who will develop symptoms, those symptoms are highly likely to start within 14 days of exposure to the virus (the so-called "incubation period", with a median incubation period of 5 to 6 days). However, it has been reported that some individuals may not be symptomatic until up to 24 days after exposure. The effectiveness of a defined quarantine period also relies on symptoms being an accurate marker that a person has contracted the virus, whereas we now know that it is possible for asymptomatic people to have contracted SARS-CoV-2 and to be contagious.

56 For those reasons, it would be sensible to test all people at the end of their quarantine period to see whether they are infected with the virus, irrespective of symptoms. If the criteria that people are not showing symptoms after 14-days is used as the sole determinant for whether people are released from quarantine, a proportion of those who are infected with the virus and potentially infectious, but who remain asymptomatic, could be released into the community.

Social (or physical) distancing

57 Social distancing is a public health practice of keeping a physical distance between people in order to minimise the spread of infection.

58 The rationale behind maintaining a social distance of 1.5 metres is that scientists estimate that infected droplets from one person's body will fall to the ground within 1.5 metres (usually within 1 metre) from that person. Once droplets have fallen to the ground, the risk of another person inhaling those droplets is considerably reduced, if not eliminated.

Personal protective equipment (PPE)

59 Appropriate PPE for those who come into contact with those identified or suspected of having SARS-CoV-2, or the environments in which such persons are living or working, includes a mask, gown, eye cover (protective glasses/goggles or face shield), gloves and suitable hand hygiene (including hospital-grade alcohol-based hand rub). These offer protection from inhalation, as well as protection from splash and/or spray from blood and/or bodily fluids, including respiratory secretions. The type (filtration grade, or quality) of the mask, the need for a respirator and the additional need for a face shield depend on the clinical circumstances and the risk of virus exposure in terms of droplet versus airborne transmission risk, risk of direct contact and risk of fomite contact. Other factors that affect the extent of PPE required in any given case depend on the duration and type of any contact with the person in question, or the environment in which they live or work (e.g. small closed space versus open outdoor space). Generally speaking, the closer the contact and the longer the duration of exposure to the person or the environment, the greater the requirement for higher level PPE. Identifying the correct PPE for a particular environment or situation requires input from those with a good understating of the virus (including its characteristics and transmission) and technical expertise in infection control.

60 Different protective masks perform different functions:

(a) Single-use face masks, also referred to as surgical masks, provide a protective barrier that prevent the spread of larger droplets from the wearer to others, as well as protect the wearer from inhaling larger droplets, and from fluid splashes or high velocity streams of bodily fluids. Recent studies have suggested that surgical masks are also effective in protecting the wearer from COVID-19 acquisition when only droplet spread is likely. Single-use face masks are rated as Level 1, Level 2 or Level 3 according to the degree of barrier protection provided. In regular Victorian hospital practice, Level 2 masks are used in a non-surgery setting and Level 3 grade masks are used by staff during operative procedures, whether these are undertaken in the ward or operating theatres.

A recent Victorian Department of Health and Human Services (**DHHS**) directive (from July 2020) suggested that for COVID-19, Level 1 masks were suitable for use in an "*Area of higher clinical risk AND where the patient is NOT suspected or confirmed to have COVID-19 and is NOT in quarantine*"; Level 2 and Level 3 masks were suitable for use in a "*Droplet and contact precautions, including direct care or contact with a person who is suspected or confirmed to have COVID-19 or is in quarantine*", but that only Level 3 masks should be used for "*All surgical procedures, major trauma first aid or whenever there is a risk of blood or body fluid splash or spray such as orthopaedic or cardiovascular procedures*".

(b) N-95 or P2 masks protect both the wearer from particles outside the mask and protect others from the wearer. Because of their higher filtration quality, N95 or P2 masks are effective in preventing the wearer from inhaling both droplet particles and the smaller droplet nuclei that can be caused by aerosolisation procedures and lead to potential airborne transmission. Thus, they are usually used when the wearer is performing a medical procedure on a patient where aerosolisation is a risk (such as taking a throat swab in a highly symptomatic patient, or intubation). Because of their higher level of filtration, single-use N-95 (P2) masks become difficult to wear for prolonged periods since moisture from the wearer's breath can cause the mask to be increasingly difficult to breathe through – hence N-95 masks often require more frequent changing than surgical masks.

(c) Cloth masks (depending on their design) stop large droplet spread from the wearer and may provide some protection to the wearer from others. In my opinion, cloth masks have no role in the hospital and quarantine settings since their filtration quality is not regulated and hence they should not be considered a valid form of healthcare PPE (in the sense that the term "PPE" is used in this Inquiry). The filtration quality of a cloth mask depends on the fabric used and the number of layers. For the general community, cloth masks appear worthwhile for providing some protection from the spread and acquisition of COVID-19, but also because they appear to result in improved behavioural change among wearers and others. Behavioural change may occur, as masks serve as a visual cue to remind people of the need to be mindful of the present risk of COVID-19 transmission, especially when interacting with others, and to maintain social distancing.

61 People must be properly trained in the wearing and use of PPE for it to be most effective. For instance, to be optimally effective, both surgical masks and N-95 (P2) masks need to be appropriately fitted to fully cover the nose and mouth and to avoid air leaks. Health professionals are themselves regularly trained in appropriate use of PPE and other infection control measures. Those with an acute understanding of infection control measures should be involved in training about how to use PPE whenever PPE is required. Without detailed appropriate training, PPE use can be ineffective and both the wearer and patient (should the wearer become infected) are placed

at high risk of infection. Appropriate training in PPE needs to result in improved knowledge and understanding, as well as demonstrable compliance with the use of PPE, as observed by an objective trained professional with detailed understanding in PPE use and infection control.

62 In my opinion, remote or online training alone is not sufficient. There must be an experiential component where there is physical supervision and instruction to ensure that people understand PPE, the reasons and circumstances of its use (and problems associated with mis-use), as well as knowing how to correctly fit, remove and dispose of their PPE correctly.

63 People should not be permitted to work in potentially dangerous environments such as healthcare facilities and quarantine areas unless they can demonstrate that they know when to use PPE and can fit, remove and dispose of it correctly.

64 Inherent in PPE training (or indeed any safety training) is a regular objective system of monitoring to ensure adherence, resolve any practice questions and to provide constructive feedback to users. Thus, an ongoing "system of supervision" should be established for infection control regimens to regularly reinforce the importance of adherence to the appropriate procedures and standards, and to ensure that adequate protections are maintained, even when one may be tired or distracted. People must understand the potential danger of infection in order to appreciate the importance of adhering to the training.

65 Quarantine environments are self-evidently "dangerous spaces" and the rigour and processes in place need to reflect and reinforce this.

66 As with all infection control initiatives, there are specific procedures that people must follow to use PPE safely and effectively – for instance, correct "donning" (putting on) and "doffing" (removing) of PPE is essential to avoid contamination when transitioning in and out of dangerous spaces. Correct procedures for wearing a mask are crucial – for instance, to remove a mask, people may only touch the side straps, not the front of the mask, since this is potentially infected. Failure to adhere to these procedures undermines the effectiveness of any PPE use, and potentially exposes the wearer to infection, as well as people outside of those environments to the risks posed within them. Furthermore, should the wearer be infected (or be developing infection – see above) and continue to work, incorrect PPE use could place the patient or quarantined individual at risk of infection.

67 At Austin Health, we aimed to undertake PPE training using a combination of an instructional video, written material, a formal program of credentialing that included directly observed adherence and the maintenance of a central database to record which staff had (and had not) been adequately trained. The Australian Department of Health infection control training module (https://www.health.gov.au/resources/apps-and-tools/covid-19-infection-control-training) was considered to be rather basic or incomplete for healthcare workers and did not include instruction about PPE. Information from the Victorian DHHS did not include a video and had some

inconsistencies in instruction about hand hygiene and glove use. For this reason, we developed a detailed instructional video focusing on these issues and PPE use consistent with the WHO material – this became available on the 13 March 2020 and was used to train all staff at the Austin Hospital. A number of non-Austin organizations subsequently used this material, including Forensicare (the Victorian Institute of Forensic Mental Health), Mercy Health and Peninsula Health.

Containment measures in a hospital setting

68 The approach to managing COVID-19 in hospitals is standardised across Victoria and nationally and it is my understanding that the system approach taken at Austin Health is representative of what should be in place at other Victorian health services, based on DHHS Guidelines. Hence, I will describe the system used at Austin Health as representing the required standard. At Austin Health, people presenting with potential or actual COVID-19 are considered within four categories:

(a) **Screening COVID** category: Consists of a specific outpatient clinic that only manages people who present for testing because they are concerned that they might have contracted the virus, either because of symptoms or potential/certain contact with a known or possible case;

(b) **Suspected COVID** (otherwise known as "SCOVID" - a portmanteau of the words "suspected" and "COVID") category: Consists of people who are suspected, but not yet proven to have COVID-19. Within this category there are two subcategories:

i. **SCOVID – symptomatic** category: Consists of specific clinical areas (wards and isolation rooms) that manage patients who initially presented with respiratory symptoms consistent with COVID-19 (but where their COVID-19 test result is not yet confirmed) or with non-COVID-related issues (e.g. a broken leg, liver failure etc), but where they also display some possible COVID-related symptoms (such as a cough). These patients remain in the SCOVID ward (or isolation room) until their test result is known – with COVID-positive cases then moved to the COVID ward and COVID-negative cases released to the relevant non-COVID unit (e.g. a COVID-negative patient with a broken leg would be transferred to the Orthopaedic Unit).

ii. **SCOVID – asymptomatic** category: These patients have presented with non-COVID-related issues (e.g. a broken leg, liver failure etc); do not display any COVID-related symptoms; but have a high-risk history/background. For instance, patients with a potentially close contact with a known COVID-19 case, patients from an aged-care facility with known COVID-positive cases, or patients who live in a known COVID-19 "hotspot". These patients remain in quarantine until their test result is known – with COVID-positive cases then moved to the COVID ward and COVID-negative cases

maintained in quarantine for 14 days until it is clear that they are not incubating COVID-19.

(c) **COVID** category: Consists of specific wards that only manage people who have tested positive for COVID-19; and

(d) **ICU-COVID** category: Consists of people who have tested positive for COVID-19 and require care in the intensive care unit.

69 For all four categories, staff cannot work in these areas until they have been fully credentialed in standard PPE use (see below). Although all patients are considered potentially COVID-infected, the PPE requirements for staff treating people in each of these categories differs slightly depending on the estimated COVID-19 transmission risk.

70 Since early March 2020, the minimum PPE requirements for staff treating persons in the following categories are:

(a) **Screening** and **SCOVID** category (i.e. Categories at paragraph 68(a) and (b)) - all staff must wear:

i. Masks and eye protection: A Level 2 surgical mask and either safety glasses or face shield (to prevent potential transmission through the eyes/conjunctiva) must be worn at all times when in the clinical area (ward, clinic, isolation rooms). Disposable face-shields are mandatory for all clinical contact, but not for non-face-to-face work in these areas, or in non-clinical areas. When a potential aerosol-generating procedure is being performed (e.g. taking a throat swab for COVID-19 testing in a highly symptomatic patient) an N-95 mask is used in place of a surgical mask and the wearer is also required to wear a face-shield. All masks are required to be changed after any high-risk exposure, at the start and end of each shift, at each work break (e.g. meal times or bathroom visits) and at least every 4 hours.

ii. Long-sleeved single-use disposable gowns are worn at all times, but changed if there has been a high-risk exposure, in addition to being changed at the start and end of each shift, and at each work break (e.g. meal times or bathroom visits). For direct patient clinical contact, a single-use disposable plastic apron is worn over the gown to avoid excess contamination of the long-sleeve gown – this is changed between each patient.

iii. Hand Hygiene and gloves: Strict adherence to the Hand Hygiene Australia and WHO's "5 Moments of Hand Hygiene" protocol for good hand hygiene before and after every patient contact, including the regular use of TGA-approved hospital-grade alcohol-based hand rub, is mandatory. Single-use disposable non-latex gloves are

used for direct patient contact (including potential aerosolising procedures) and when coming into contact with potentially contaminated surfaces or objects (fomites) – these are changed between each patient contact or between each exposure event.

(b) **COVID** and **ICU-COVID** categories (i.e. Categories at paragraph 68(c) and (d)) - all staff must wear:

i. Masks and eye protection: As per categories 68(a) and (b). In ICU a disposable face-shield is worn continuously when in isolation rooms. For extremely high risk procedures in ICU, such as intubation or bronchoscopy, where anaesthetists and other clinicians who are being directly exposed to high concentrations of respiratory secretions, a medical respirator is sometimes worn in place of an N-95 mask, on a case-by-case basis.

ii. Long-sleeved single-use disposable gowns: As per categories 68(a) and (b), except that in ICU when high-risk procedures are being undertaken and a respirator is being used, staff may wear a full-body disposable suit rather than disposable gowns.

iii. Hand Hygiene and gloves: As per categories 68(a) and (b) except that in ICU, this means gloves are worn continuously when in ICU isolation rooms.

71 Patients in the "Screening" and "SCOVID" categories are treated as potentially infectious, even though they have not (yet) tested positive for the virus. The movement of those patients within the hospital is reduced as much as possible (as are COVID patients), and they are required to wear a mask in shared spaces (for example, if a person from a "SCOVID ward" travels to another part of the hospital in order to have an X-ray).

72 The correct disposal of potentially contaminated/infectious PPE waste (gowns, gloves, masks) is an important consideration since these items should not be discarded in "general waste". "Infectious waste" is substantially more expensive to manage than "general waste".

73 All Austin staff are required to maintain a social distance of 1.5 metres. Generally, Austin Health staff are discouraged from sitting in the tea rooms, but if they do so, then they are required to maintain appropriate (1.5 metre) distancing and therefore over-crowding is avoided. Nevertheless, tea rooms are a potential risk area for transmission, since staff need to remove their masks to eat and drink.

74 If a hospital staff member is exposed to a positive case (whether inside any of the COVID units or outside in the routine wards), we determine whether they are a "casual contact" or a "close contact" based on the duration of contact time (greater than, or less than 15' cumulative face-to-face [≤1.5m] exposure time; or ≥2 hours non-face-to-face time), and whether they were wearing appropriate PPE for the relevant ward area and the procedures they were undertaking. All close contacts are

furloughed (hospital-mandated) or quarantined (DHHS-mandated) for 14 days from the date of exposure and are tested at identification baseline and at Day 11 (ready for clearance at Day 14). No such staff may return to work unless their Day 11 COVID-19 test is negative and they have no symptoms on Day 14.

75 Infection control regimens in the hospital are regularly reinforced to staff through weekly CEO-led webinar presentations with the Infectious Diseases Department about COVID-19 infection control measures, direct monitoring of adherence by the Nurse Unit Manager on each clinical area, regular visits to wards by infection control staff to observe behaviour, widely displayed infection control signage throughout the hospital and biannual re-credentialing in hand hygiene. As has been well published, educational signage alone has only limited value in reinforcing behaviour, unless they are updated frequently, since they quickly become ignored. In addition, if the signs are only in English, they may not be fully understood by people where English is not their first language.

76 Given the potential risk of pre-symptomatic or asymptomatic COVID-19 among many returned travellers (depending on their source country, but also the nature/infectivity of the other passengers on their in-coming or connecting flight(s)) and the importance they pose to undermine other Australian COVID-19 control initiatives, it is my view that all such returned travellers should be considered from an infectious diseases and infection control point of view as having a COVID-19 risk profile similar to those in Austin Health's "SCOVID - asymptomatic" category. Thus, in my view, the hotel quarantine environment, duration of quarantine and infection control measures, including PPE use, should be the same as that used in our "SCOVID - asymptomatic" category of care. A minimum PPE standard of mask, eye protection, long-sleeved single-use disposable gown and appropriate hand hygiene measures (alcohol-based hand rub or soap/water handwashing) would be appropriate for duties such as patrolling hotel corridors to "enforce" quarantine by non-contact measures. However, if direct physical contact was likely or possible, gloves should also be worn. Gloves would also need to be worn (in addition to the above PPE) for duties such as removing food trays from outside hotel rooms (since fomite transmission is possible); and escorting persons quarantined from their rooms to open air spaces for recreation breaks (since direct physical contact is possible).

Signature _____

Print name PROFESSOR M. LINDSAY GRAYSON

Date 10th August 2020