TRANSCRIPT OF PROCEEDINGS

INQUIRY INTO THE COVID-19 HOTEL QUARANTINE PROGRAM

BOARD: THE HONOURABLE JENNIFER COATE AO

DAY 3

10.02 AM, MONDAY, 17 AUGUST 2020

MELBOURNE, VICTORIA

MR A. NEAL QC appears with MS R. ELLYARD, MR B. IHLE, MR S. BRNOVIC and MS J. MOIR as counsel assisting the Board of Inquiry

MS J. CONDON QC appears with MS R. PRESTON and MR R. CHAILE for the Department of Jobs, Precincts and Regions

MR A. MOSES SC appears with MS J. ALDERSON for Unified Security Group (Australia) Pty Ltd

MS H. TIPLADY appears for Department of Justice and Community Safety

MR R. ATTIWILL QC appears for Department of Premier and Cabinet

MR A. WOODS appears for Rydges Hotels Ltd

MR S. PALMER appears for Melbourne Hotel Group Pty Ltd trading as Holiday Inn Melbourne Airport

CHAIR: Thank you. Yes, Mr Neal.

MR NEAL: I appear with my learned friends Ms Ellyard, Mr Ihle, Mr Brnovic and Ms Moir to assist you today.

CHAIR: Thank you. I understand there are appearances on behalf of other parties who have leave to appear so I'll take those appearances now. Just remember to unmute your microphones as you make your appearances.

MS HARRIS: Your Honour, I appear on behalf of the Department of Health and Human Services, Claire Harris QC.

CHAIR: Thank you, Ms Harris.

MS TIPLADY: Your Honour, I appear on the Department of Justice and Community Safety; Helen Tiplady.

CHAIR: Thank you, Ms Tiplady.

MR ATTIWILL: I appear on behalf of the Department of Premier and Cabinet, together with colleagues; Richard Attiwill.

CHAIR: Thank you, Mr Attiwill.

MR WOODS: I appear on behalf of Rydges Hotels Ltd; it's Andrew Woods.

CHAIR: Thank you, Mr Woods.

MR PALMER: If the Board pleases, I appear on behalf of Melbourne Hotel Group; Stephen Palmer.

CHAIR: Thank you, Mr Palmer. Any other appearances?

MS CONDON: I appear on behalf of the Department of Jobs, Precincts and Regions; Julie Condon QC.

CHAIR: Thank you, Ms Condon.

MS ALDERSON: If it pleases the tribunal, my name is Jaye Alderson and I appear for Unified Security Group with my leader, Mr Arthur Moses SC, as counsel.

CHAIR: Thank you. Any further appearances to be announced this morning?

I think we are ready to proceed, Mr Neal.

OPENING STATEMENT BY MR NEAL QC

MR NEAL: Today we will commence the evidentiary hearings of the Inquiry.

Before we call the first of the witnesses and to place the evidence in the context of the board's Terms of Reference, it is convenient that I set out a number of matters: firstly, the chronology of the events that led to the establishment of the Hotel Quarantine Program the subject of this Inquiry; secondly, a summary of the powers that were available to be exercised and that were exercised in the establishment of the Hotel Quarantine Program; a summary of this Board's functions; an overview of the themes that are emerging from the Inquiry's review of the now 180,000 pages of documents that have been obtained from the relevant bodies and persons; and, lastly, an overview of the way in which these themes will be explored through the public hearings.

If I turn, then, firstly to the chronology of events leading to the establishment of the Hotel Quarantine Program. This Board of Inquiry was appointed on 2 July 2020. As this Board noted in its own remarks on 5 August, at the time the Board was established, Victoria was under Stage 2 restrictions and a State of Emergency. By the time of its first hearing on 20 July 2020, Stage 3 restrictions applied. On and from 2 August 2020, Victoria was in a declared State of Disaster and Stage 4 restrictions were imposed shortly thereafter.

That rapid change in the restrictions level imposed in Victoria reflected the increase in the number of COVID-19 cases being identified in Victoria. That continued increase has been due to a range of factors, including, firstly, the nature of COVID-19 as an illness itself.

The evidence that you will hear today and tomorrow will indicate, firstly, that it is a respiratory disease, that it is a highly infectious disease, that it is transmissible by face-to-face contact, but also contact from surfaces that an infected person has been in contact with; that whilst droplet transmission seems to be the primary source of transmission of the disease, there appears to be good evidence of it also being airborne, at least in certain physical environments. Lastly, this is a disease which is infectious whilst one is asymptomatic.

The second perhaps compounding factor to the nature of the disease is the home and work settings through which those who were infected by it were then moving. It is important to note at the outset that it is not an inquiry at large. This Inquiry is not an inquiry into the general governmental response to COVID-19 or to the spread of COVID-19 throughout the Victorian community. It is, rather, an inquiry into the Hotel Quarantine Program that was established for returning overseas travellers and which operated from 28 March of this year.

However, as the Terms of Reference of this Board note, the Board was established in the context of evidence, as at 2 July, which linked the rise of infections to quarantined travellers. It was in that context that I said in the opening to you on 20

July that it might be that every positive case in Victoria as at that date could be traced to hotel quarantine. When I made those remarks I was actually quoting from the Chief Health Officer.

Today and tomorrow, evidence will be called before you regarding the nature of COVID-19 as an illness and what genomic and epidemiological evidence can tell us about the extent to which infections now seen in Victoria are indeed traceable back to international travellers. That evidence is intended to provide context and focus for the remainder of the evidence to be called in the public hearings about how the Hotel Quarantine Program was established and operated and where any limitations, deficiencies or failings may have occurred. How rapidly events have unfolded since your appointment has something in common with the rapidly unfolding events in the lead-up to the establishment of the Hotel Quarantine Program itself.

I now wish to turn to some of the key dates leading up to the establishment of the program.

In late 2019, the world's attention was drawn to Wuhan in China, where reports were emerging of an unknown pneumonia-like disease. At the time, linkages were made to a seafood market, but that picture was somewhat confounded by cases emerging in other Asian countries apparently with no link to the Wuhan market. On 10 January, Victoria's Chief Health Officer issued a health alert with respect to patients who had travelled to Wuhan, China, and who experienced the onset of fever and respiratory symptoms within two weeks of their return. The alert acknowledges the concern that what has been referred to as "viral pneumonia" may be a novel coronavirus. On 20 January of this year, the Australian Health Protection Principal Committee, which comprises the Chief Medical Officer of Australia and all the Chief Medical Officers of the States and Territories, met for the purposes of considering a national response to the COVID-19 disease.

On 29 January, there was the first recommendation from the Commonwealth Chief Health Officer that anyone who was travelling from Hubei Province in China should self-isolate for 14 days. On the same day, the Victorian Health Public Health Regulations were amended to require that the Department of Health and Human Services be notified of any positive cases. COVID-19 became a notifiable disease.

On 30 January 2020, the World Health Organisation declared COVID-19 to be a public health emergency. On 1 February, recognising that COVID-19 was a class 2 emergency, as that term is used in the *Emergency Management Act* and the Emergency Management Manual of Victoria, a designated State Controller of Health was appointed. Notwithstanding that the Victorian Action Plan for the Influenza Pandemic 2015 provides that the role of State Controller for Health is to be assumed by the Chief Health Officer, the Director of the Emergency Management Branch within the Department of Health and Human Services was actually appointed to that role.

On the same day, 1 February, and in succeeding weeks, advice for home

self-isolation was extended to include arrivals from a range of other countries. Travel bans were instituted for travellers from China and then later those from Iran, South Korea and Italy, all of which countries were during February and March experiencing widespread COVID-19 infections.

On 11 March the World Health Organisation officially declared COVID-19 to be a pandemic.

On 15 March there was an inaugural meeting of the National Cabinet, the National Cabinet consists of the Prime Minister as well as the Premiers and Chief Ministers of the States and Territories. It was created to address and ensure consistency in Australia's response to COVID-19. The Australian Health Protection Principal Committee is a key adviser to the National Cabinet on matters of health.

On 16 March 2020 the Victorian Minister for Health declared a State of Emergency under the *Public Health and Wellbeing Act 2008*. Directions were issued on the same day requiring that those arriving in Victoria from overseas by air should self-quarantine at home as follows:

> *A person who arrives at an airport in Victoria on a flight that originated from a place outside Australia or on a connecting flight from a flight that originated from a place outside Australia must travel from the airport to a premises that is suitable for a person to reside in for a period of 14 days.*

Previously I referred to that as the residential quarantine regime.

On 18 March, the Deputy Chief Health Officer of Victoria issued a direction to people arriving in Victoria from overseas between 5.00 pm on 18 March and midnight on 13 April that "they must go into immediate compulsory isolation for 14 days at a premises that is suitable for them to reside in for 14 days". That direction also adds that:

> *Returnees must not leave their residence under any circumstances unless they have permission;*
>
> *Returnees must not permit any other person to enter their room, unless the person is authorised to be there for a specific purpose (for example, food or medical reasons).*

That is what I previously referred to as the more stringent residential quarantine regime.

In the week from 20 to 27 March directions were made restricting gatherings, movement and activities across the broader Victorian community. On Friday 27 March the National Cabinet met. As I outlined in the first hearing, the National Cabinet determined that returning travellers arriving back in Australia would be required to undertake their mandatory 14-day self-isolation at designated facilities,

for example, an hotel.

The National Cabinet further determined that designated facilities will be determined by the relevant State and Territory governments and implemented using State and Territory legislation and enforced by State and Territory governments with the support of the Australian Defence Force and the Australian Border Force where necessary.

On 27 March there was a meeting inside the Victorian State Control Centre. The State Control Centre is Victoria's primary control centre for the management of emergencies. Emergency Management Victoria has the legislative responsibility for the management of the State Control Centre. That meeting, it would seem, was chaired by the Emergency Management Commissioner. The outcome of that meeting was that steps were set in train so that a Hotel Quarantine Program could be established in time for the deadline at midnight the following day.

On 27 and 28 March, officers from a number of Government Departments worked to establish the Hotel Quarantine Program in time to receive the first of the returned travellers. Those first arrivals were placed into hotel quarantine on the morning of 29 March 2020. The fundamentals of the program were the exercise of statutory powers of detention and the use of hotels as a place of detention.

The power to detain, the power exercised by the Chief Health Officer or his delegate and the authority to enforce the detention was exercisable by authorised officers under the *Public Health and Wellbeing Act*, in the first instance officers of the Department of Health and Human Services. The Department of Jobs, Precincts and Regions was initially tasked with sourcing and contracting the hotels at which the passengers were to be detained. Early iterations of the plan for the planned Hotel Quarantine Program, prepared first by the Department of Jobs, Precincts and Regions and then by those working within the State Control Centre, include roles for multiple other agencies.

The evidence that you will hear in this Inquiry will raise questions as to the clarity of the roles of those individual agencies. From the very beginning, it seems there were multiple and potentially overlapping areas of responsibility between departments. Evidence will be called in due course about the roles that some departments envisaged playing when the program was first established and how they differed from the roles that they actually played as the program commenced and continued.

By 29 March the name Operation Soteria was given to the plan for hotel quarantine. For those who are interested, Soteria is the Greek goddess of rescue and safety. The scope of Operation Soteria and the ultimate responsibility for the Hotel Quarantine Program are issues for this Inquiry.

The operation did not include an active frontline role for the Australian Defence Force or for the Victoria Police. It envisaged, rather, private security companies would be engaged to enforce quarantine requirements at the accommodation. Why

that was so is an issue for the Inquiry.

The arrangements put in place on 28 March were then expanded and amended over the subsequent days and weeks. Part of the Inquiry's work involves identifying and understanding --- and it is no easy task --- the way in which the Hotel Quarantine Program's operational and governance structure worked or was intended to work; where lines of accountability between different organisations lay; how the structure was actually populated and resourced; whether and how disparate parts of the operation were coordinated and supervised, including those parts which relied on private providers.

Various iterations of Operation Soteria had many different moving parts involving different agencies with separate roles. An issue will be whether it was too fragmented to work efficiently, especially given the need for quick coordinated action that is proposed in the emergency environment.

Some key events and issues in the creation, expansion and amendment of the Hotel Quarantine Program appear to include the following: the initial meeting on 27 March 2020 at the State Control Centre and subsequent meetings on 28 March, through which decisions were made about who would coordinate the hotel program and who would be the lead agency in it. Decisions made in those early days regarding the respective involvements of the ADF, Victoria Police and private security companies is also in issue.

The appointment of the Deputy State Controller with a focus on hotel quarantine on 29 March is a matter which needs to be better understood.

The establishment of an Emergency Operations Centre for Operation Soteria on 17 April, which replaced the role of the Deputy State Controller with a specific COVID-19 accommodation commander, is also an event worthy of understanding.

Furthermore, the engagement of the infection prevention consultant in various stages of the program needs to be understood in terms of when and why. Changes in protocol over the time of the program with regard to returned travellers and how that was being tested is also a matter which we need to better understand.

The decision to designate a hotel for the use of all COVID-19 positive cases, the so-called red hotel idea, is another matter of interest for the Inquiry, and the evidence of infections occurring among those working at the designated hotels and at a second such hotel.

From the middle of June onwards the Hotel Quarantine Program underwent substantial changes as part of what appears to have been a review of its operation, in light of issues, including the fact of some infections amongst those working at the two hotels. Those substantial changes included: Alfred Health taking on clinical and non-clinical roles at hotels where people with COVID-19 were being quarantined; the involvement of Corrections Victoria staff, including new employees from

backgrounds including airline staff, as residential support officers to supervise those in quarantine; the ending of the use of private security guards and, as from 8 July 2020, the transfer of responsibility for functions relating to detention of overseas travellers to the Attorney General, so that the Department of Justice and Community Safety assumed operational responsibility for the Hotel Quarantine Program.

In addition to those changes, the decision by the National Cabinet in July to divert all international flights away from Victoria means that for some weeks now there have been no international arrivals into Victoria requiring quarantine. These changes mean, as the Board noted at an extraordinary sitting on 5 August, that the Hotel Quarantine Program as it was established in March 2020 is not operating in the same form. However, having regard to the continuing level of COVID-19 infection worldwide, it is entirely possible that such a program will be required again in the future and that there remains great utility and purpose in the Board's work.

The changes to which I have adverted invite consideration of whether the Hotel Quarantine Program created in March and the allocation of responsibilities under Operation Soteria were indeed appropriate. These and other issues will be examined in the evidence that is to be called before you.

I wish to turn now to the question of the authorising environment in which the Hotel Quarantine Program was established. The Terms of Reference call on the Board to inquire into the decisions and actions of Government agencies and of hotel operators and private service providers, including security, transport, medical and food providers. To do so requires consideration of the authorising environment, the legislative and governmental arrangements within which the decisions and actions of the government were taken.

The authorising environment in this case relevantly includes the *Emergency Management Acts* 1986 and 2013, the *Public Health and Wellbeing Act 2008*, the Emergency Management Manual and the State Emergency Response Plan. Each of those documents requires and will be given separate consideration in the Inquiry, including consideration of how they relate and interact with each other.

The *Public Health and Wellbeing Act* is clearly an essential piece of legislation in the Hotel Quarantine Program. Under section 198 of that Act, a State of Emergency can be declared where there are circumstances causing a serious risk to public health. A declaration is made by the Minister of Health on the advice of the Chief Health Officer and after consultation with the Emergency Management Commissioner and the Minister for Emergency Services. From the date on which a State of Emergency was declared on 16 March, the Chief Medical Officer or his delegate, Deputy Chief Medical Officer, could authorise the exercise of emergency powers where he or she was satisfied that it was necessary to eliminate or reduce the serious risk to public health. The relevant power contained in section 200 of the Act includes powers to:

(a) .... detain any person or group of persons in the emergency area ....

(b) .... restrict the movement of any person or group of persons within the emergency area;

(c) prevent any person or group of persons from entering the emergency area;

(d) give any other direction that the authorised officer considers is reasonably necessary to protect public health.

It is these powers that were used to detain returned travellers in hotel quarantine, as well as a range of directions which have imposed restrictions and limitations on movement, work and activities in Melbourne and in wider Victoria. They are powers only exercisable where there is a State of Emergency.

Relevantly, section 202 allows authorised officers to be assisted by any person in exercising the power under section 200. That said, a request to be assisted by a police officer must be made to the Chief Commissioner of Police or delegate.

Section 203 makes it an offence not to comply with a direction such as a detention notice and sets out the penalties which apply for non-compliance --- a monetary fine.

There are relevant nonemergency powers within the *Public Health and Wellbeing Act*. The Chief Health Officer or his delegate could exercise power potentially under section 113, which allows that there be a direction given to a person to be tested for an infectious disease. There is a penalty again for noncompliance and a person can be detained in isolation for a period not exceeding 72 hours if they don't comply.

Interestingly, whilst force can be used by a police officer to detain a person subject to such a regime, the administration of the test itself cannot be done by force. Evidence will be called that the testing for COVID-19 in the Hotel Quarantine Program was done only on a voluntary basis. Later in the life of the program, from 1 July onwards, those who actually refused to be tested could be detained for an additional period of time, but testing was never made mandatory. This aspect of the legislative regime may be a matter the Inquiry considers in its report.

Turning to the emergency management regime, under the *Emergency Management Acts* and the Emergency Management Manual Victoria, an emergency relevantly exists and includes a plague, an epidemic or contamination. Emergencies under this legislation are classified as either class 1 or class 2. Class 1 is reserved for major fires and similar situations; infectious diseases are class 2 emergencies. Where such a class 2 emergency is occurring, there are roles provided for the Emergency Management Commissioner under section 32 of the *Emergency Management Act 2013* and the control agency depending on the nature of the emergencies.

The Emergency Management Commissioner has responsibility relevantly for: coordinating the activities of agencies that have roles and responsibilities in a class 2 emergency; ensuring that control arrangements are in place; managing the State Control Centre on behalf of and in collaboration with all other agencies; and for conse

quence management.

The *Emergency Management Act 2013* also mandates the preparation of State Emergency Response Plan which specifies which agency shall be the control agency in any particular emergency. For a health or human disease emergency, the relevant control agency is the Department of Health and Human Services. The State Emergency Response Plan contains sub-plans for different kinds of emergencies. There is a health plan called the State Health Emergency Response Plan. There is a pandemic plan for influenza. There is a specific COVID-19 plan published on 10 March 2020 for the Victorian health sector.

None of these plans contemplate a regime of mandatory detention in hotels for quarantine purposes. The extent to which these emergency management powers and processes were given effect in the hotel quarantine is one of the matters into which the Board will be inquiring.

Could I now turn and update the Board on the steps that have occurred since the first hearing? Since 20 July, this Inquiry has received and has been working through more than 180,000 pages of documents received from agencies, private entities and individuals. It is obtaining witness statements from a number of persons, both from within government and from those working in private businesses associated with the Hotel Quarantine Program. The Inquiry is also being assisted by members of the public who have made contact via the Intake team and who have provided documents and witness statements about their experiences and their observations. Some of those people will be witnesses before the public hearings. All of their experiences will be relevant and considered as part of the Inquiry's work.

The issues that we consider to be live before the Inquiry: the Inquiry is ongoing and documents and witness statements will continue to be received over the coming weeks. It is for that reason, while a range of issues can be identified as requiring some degree of investigation and clarification, it is not possible or appropriate at this time to definitively state the entirety of issues or questions which the Inquiry will consider and resolve. What can be said is that the issues warranting consideration under the Terms of Reference include the following themes which arise in various ways and which will be explored through multiple witnesses: firstly there is the question of structure. How was the Hotel Quarantine Program structured? Were roles allocated appropriately within the structure, including as between government and private providers? What powers were exercised and by whom? Were contractual arrangements appropriate? Were they appropriately monitored and faithfully executed? Was the structure set in place appropriate, acknowledging that this was, first and foremost, a public health emergency, albeit needing the support and involvement of emergency and non-health agencies?

Secondly, there is the issue of timing and preparation. The initial set-up of the Hotel Quarantine Program was undertaken in 48 hours and represented a very considerable logistical effort. Decisions were made quickly and in the absence, it seems, of precise lines of responsibility, control, supervision and management. Given the

complex health environment in which people were being mandatorily detained, how was the initial set-up bedded down and revised? What time was taken to be able to review the appropriateness of hotel arrangements and security arrangements in the weeks following its inception? It is in the nature of emergencies that they arise without warning. Whilst the precise characteristics of COVID-19 may not have been foreseen, planning for a pandemic has been the subject of formal plans, both at Commonwealth and State level, for many years. How well prepared, in the circumstances, was Victoria to create and run a program of this kind for an emergency of this kind?

To the extent that the existing emergency management structures were used, were they indeed useful? Did they meet the demands of the pandemic and the Hotel Quarantine Program?

Thirdly, there is the question of resourcing. The Hotel Quarantine Program placed very significant demands on multiple government agencies in the areas of procurement, staffing, management and personal protective equipment. There were thousands of passengers in hotel quarantine whose needs had to be met in every respect. The departments tasked to respond were in some cases, at least, acting outside their usual remit and scope of expertise. How were those staff identified, allocated, trained and supported? Were the numbers sufficient to meet the demands of the program?

The program required large numbers of hotel rooms and hotel staff. How were those hotels identified and how did they meet the requirements imposed by quarantine and COVID-19, both for guests and staff? It should be observed that this was first and foremost a quarantine program rather than an accommodation program. A further attached question might be how was cleaning and infection control to be managed?

The program also required the deployment of a large number of private security guards to the hotels. The questions which arise are: why were they chosen? What was understood as the role that they were to play, either at the beginning or in due course? What was the skill set that they brought to the job that they were required to do? How indeed were they trained, resourced and supervised? Did they have appropriate access to personal protective equipment and infection control measures? How were they trained and did they effectively use that equipment?

Fourthly, there is the question of impact. It is no small thing for the Government to compel people who have committed no offence and done no wrong to stay inside a hotel room for 14 days with no or limited opportunity for fresh air or exercise and no or very limited ability to pick up the threads of their ordinary lives. The Hotel Quarantine Program made huge demands, in the interests of public health, on more than 20,000 returning travellers, most of whom did not have COVID-19 and many of whom had their own personal and health complexities to deal with. How those demands were to be balanced against the public health imperatives the program was created to serve appears to have been an ongoing theme for those running the program and a matter which influenced decisions about exemptions or changes to

quarantine.

The program also made huge demands on those working in it. It appears that many Government staff worked long hours and took on duties outside their normal roles and the demands for security and other staff may have also led to overwork. The impact on quarantined passengers had a flow-on impact to the staff, including hotel staff and nursing staff.

The fifth issue, questions of governance and lines of supervision and accountability. Fundamentally, who was running the program and who was accountable for its work? The material available to the Inquiry indicates key roles for at least the following: the Department of Health and Human Services, the Department of Jobs, Precincts and Regions and Emergency Management Victoria. There were, within the operation known as Soteria, multiple command structures within departments and between departments. What level of control or influence was exercised by public health experts as opposed to those whose expertise lay elsewhere?

There is material suggesting that for some participants in the program it was not clear who was in overall command of the operation.

Sixthly is the question of the lessons to be drawn and the recommendations to be made. What could have made the Hotel Quarantine Program work better? What could be done to prepare for future pandemics or other emergencies that require this sort of emergency response?

In considering those recommendations, it will be important to distinguish between findings the Inquiry makes about any systemic deficiencies in the program from findings that can be made about the impact of those deficiencies, that is, whether any of them were in fact causes or contributors to the outbreak of COVID-19 that can be linked to the Hotel Quarantine Program.

It is very clear that some persons working in the Hotel Quarantine Program themselves became infected with COVID-19. If the intent of the program was to prevent returned travellers from infecting other people with COVID-19, then to that extent it fell short of its goal.

However, many others who were working in the program did not become infected. Most of the thousands of workers involved did not become infected. This suggests that the majority of those who were quarantined and who did in fact have COVID-19 did not infect anybody else. The evidence to be called today and tomorrow will go into that very issue.

I turn now to the question of future hearings. In subsequent public hearings, evidence will be called from a range of persons representing the following: people who worked in the creation and establishment of the hotel quarantine system, people who worked in the hotels where passengers were quarantined, people who observed and experienced the Hotel Quarantine Program, including returned travellers in

quarantine; people who had roles as authorised officers, safety officers, security guards or security managers, nurses and cleaners; senior departmental officers and Ministers.

The first set of witnesses to be heard today are assisting the Inquiry with expert medical, genomic and epidemiological evidence. Later this week and into next week, evidence will be called from a number of individuals who worked in or were quarantined at one or more of the hotels in the program. It will be the endeavour of Counsel Assisting the Inquiry, after each grouping of witnesses, to identify what appear to be the issues which arise and which may be the subject of interest to the Board. Necessarily, they can only be preliminary observations.

It would be remiss in an opening of this sort not to make comment about the nature and the work of an Inquiry. This Board is established by an order of the Executive government. However, once it is created the Board is and acts independently of the Executive, both in terms of its procedure and of course in terms of its substance. That independence is a fundamental feature of the Board and reflects the public purpose which it is intended to serve as is evidenced by the structure of the Act.

This Board is not engaged in a political exercise nor is its task conducted on behalf of any sectional interests. As the Board itself has made clear, the Inquiry is conducted on behalf of all Victorians.

Unlike the work of a court, the Board's work is not to make findings about liability, be they criminal or civil. That said, its role is to enquire into the Hotel Quarantine Program and make any findings that are necessary. This must include, where it is appropriate, findings that decisions or actions were wrong or that policies and procedures were inadequate or not followed.

If the Board pleases, those are the opening remarks I wish to make.

CHAIR: Thank you, Mr Neal. I understand you are in a position to call the first witness, Professor Grayson. Perhaps we will take a short break to enable Professor Grayson to be prepared and ready to give evidence. Perhaps if we return -- - it is just short of 15 minutes --- at 11.05 am. We will resume at 11.05.

ADJOURNED **[10.49 AM]**

RESUMED **[11.04 AM]**

CHAIR: Professor Grayson.

REMOTE HEARING OPERATOR: Perhaps we could have a short recess where we could speak to Professor Grayson.

CHAIR: All right. My apologies, everyone. We will take another few minutes. Please don't go away. I will go off the bench for a few minutes while Professor Grayson is being connected appropriately.

ADJOURNED [11.09 AM]

RESUMED [11.17 AM]

CHAIR: Good morning, Professor Grayson.

PROFESSOR GRAYSON: Good morning, your Honour.

CHAIR: You are able to see me. Can you hear and see Mr Neal as well?

PROFESSOR GRAYSON: Yes, I can.

CHAIR: I understand that you wish to take the oath for the purposes of giving your evidence. I will hand you over to my associate to administer the oath.

PROFESSOR LINDSAY GRAYSON, SWORN

EXAMINATION BY MR NEAL QC

Q. Your full name is Michael Lindsay Grayson?

A. Correct.

Q. You have made a statement to the Inquiry dated 10 August 2020?

A. Yes.

Q. Do you have a copy - do you have your statement to hand?

A. Yes, I do.

Q. To the best of your knowledge, is the content of your statement true and correct?

A. Yes.

MR NEAL: I tender the statement of Professor Grayson.

CHAIR: Exhibit 1.

EXHIBIT #001 - STATEMENT OF PROFESSOR GRAYSON

MR NEAL: You have tendered a lengthy curriculum vitae. Does the Board wish to have that as a separate exhibit?

CHAIR: We will make that a separate exhibit, Mr Neal. Exhibit 001 will be Professor Grayson's statement, Exhibit 002 will be the curriculum vitae of Professor Grayson.

EXHIBIT #002 - CURRICULUM VITAE OF PROFESSOR GRAYSON

MR NEAL: Professor, you are the Director of the Infectious Disease Department of the Austin Hospital?

A. Yes.

Q. I know you often have a number of roles. Can I call that your main job?

A. Yes, that's correct.

Q. The witness statement that you provided to the Inquiry is in the form of answers to questions which were posed to you. I don't wish to read out the statement nor to have you do so, but I would like to take you to some of the more salient points of the statement so they are accessible to a broader audience than those who just read your statement. That's the way we might proceed.

A. Okay.

Q. You are the Professor of Infectious Diseases in the Department of Infectious Diseases and the Department of Microbiology at the Austin Hospital. Other positions which you hold are honorary professor in the Department of Epidemiology in Preventative Medicine at Monash University?

A. Yes.

Q. You are also the Director of Hand Hygiene Australia based at Austin Health?

A. Yes.

Q. You are an infectious diseases physician at Bendigo Health and Mallee-Loddon

region Bendigo?

A. Correct.

Q. You are a professor of medicine, in the Faculty of Medicine, Dentistry and Health Sciences at the University of Melbourne?

A. Yes.

Q. If I could take you in the first instance to matters that you actually deal with at paragraphs 8 and onwards of your witness statement, you were involved as the Director of Infectious Diseases at Austin Health and then as Director at Hand Hygiene Australia. Could you explain to us the nature of the work that is done by the Infectious Diseases and Microbiology Department at Austin Hospital and your role as its director?

A. I am head of the Department of Infectious Disease and obviously we provide inpatient and outpatient infectious disease services to the hospital and the broader community. The hospital has a number of very complex service units, many patients of which are immunocompromised and that's a key part of our role. Obviously in relation to this pandemic, the Infectious Disease Department at Austin is in charge of the COVID unit and the COVID response of the hospital is led by both the director of the COVID services and deputy director are part of my department and the Director of Infection Control is another member of my department and I oversee the entire department, including those individuals.

As director of Hand Hygiene Australia, the Hand Hygiene Australia was involved for the past decade, up until Christmas, with the launch and then embedding and maintenance of the National Hand Hygiene initiative which was about ensuring the introduction of alcohol-based hand rub and improved hand hygiene amongst health care workers throughout all Australian hospitals and that has now become part of a mandatory regulation for hospital accreditation.

MR NEAL: If the Board pleases, there has been a sharing of Professor Grayson's statement, but for the purposes of this witness I don't particularly require that. I would rather concentrate on what Professor Grayson is saying himself.

CHAIR: All right. If the document --- you don't need the document on the screen, Mr Neal, it can be taken down?

MR NEAL: I don't. I think it is a distraction for him, in this instance. Thank you.

Q. Professor, the nature of COVID-19 is something that you do address in your witness statement. You state, amongst other things, that it is --- the current SARS-Coronavirus-2, the novel coronavirus as it is called, is a coronavirus obviously. Does it bear some relationship with what we are familiar with from 2003, the so-called SARS virus at that time?

A. Yes, it is in the same family of viruses as SARS and MERS-CoV, the Middle Eastern coronavirus.

Q. Can I take it that it's also relevantly different?

A. Can you repeat that?

Q. Can I take it, it is also relevantly different, that is, the novel SARS virus from the one that we experienced in 2003?

A. Yes, SARS in 2003 was somewhat different in that almost all the patients who contracted the virus were very symptomatic and it had a substantially higher death rate than the current virus strain. So in that sense it was easier to detect those individuals who had been infected with SARS because they were sick and hence case identification was easier and --- easier in one sense, of course, more serious in another for other reasons --- but that was a key difference, both in terms of the severity of the illness that it caused and then also the associated mortality and also risks to health care workers at the time.

Q. Did the 2003 SARS virus impact in Australia?

A. Yes. According to WHO, our notification to the World Health Organisation, there were six cases, six probable cases, of which, depending on reports, only one was actually confirmed. So the impact on Australia was relatively mild and all those cases were identified rapidly.

Q. Did you personally have any experience in working in that, or against that outbreak?

A. No, no. At the time, just with the relatively small number of cases, I was not involved in that.

Q. In terms --- perhaps I should clarify the terminology --- the virus we would call the SARS-Coronavirus-2, that is the virus, and COVID-19 is the disease?

A. Yes, we can --- sounds good.

Q. If we can talk about the virus and the way it invades the body, could you give us an explanation of that, please?

A. Yes. So the virus is --- if one is exposed to the virus, and its usual entry point is usually through mucosa, either --- or most notably through the lungs, the epithelial lining of the lungs but also through other mucous membranes, the mouth, potentially conjunctiva, and so the virus enters through those cells, there are certain receptors it links onto, it enters the body and then disseminates through the body and in --- causing a systemic illness. Indeed, although the entry point in the main, symptoms

are usually related to the respiratory tract, namely upper respiratory tract or lower respiratory tract as in the lungs, it affects the entire body in those cases, those patients who are sick, and indeed, has been detected in faeces, showing that it can also involve the gut eventually.

Q. Are there symptoms that are classically associated with it?

A. Yes. So, obviously, respiratory symptoms as I stated in my witness statement, there are clear respiratory symptoms that are the dominant feature. So cough, shortness of breath, fever. What is unusual with this particular virus is loss of sense of taste and smell together is rather unique. It is common to lose a sense of smell when one has any upper respiratory tract viral infection, but to lose both is rather pathognomonic or definitive of this particular infection. It doesn't happen to a lot of people, but when it does, it has been shown in various studies to be highly, highly suggestive that in fact it is COVID-19 that one has.

Q. Is there reliable data at the moment about whether COVID-19 affects different age groups differentially?

A. Yes. It depends on the health care setting but it appears overall, if we are talking in general terms, that children are less affected than older adults and that older adults are more affected in terms of symptoms and their associated severity of the illness and eventually their mortality is greater the older one is. Also, of course, those who have weakened immune systems for various reasons, it is presumed they are also at greater risk. So what is unclear is whether ageing --- the reason that the disease affects older members of the community it's uncertain whether that is just because of age or whether it is the altered immunological effects of ageing, that as one gets older in general, your immune system weakens.

Q. I am unhappy to hear!

From paragraph 17 and onwards of your witness statement you refer to the concepts of viral load and viral shedding. Could you explain to us each of those concepts, please?

A. Viral load is really just the amount of virus that is present, either --- it depends on where you are discussing it, whether it is in the whole body or in the respiratory tract. For instance, the infection control we are often concerned about is the viral load in respiratory secretions and in terms of droplets, and therefore the infectiousness of those, so the greater the amount of virus, the presumed greater infectiousness of that patient. Shedding is in terms of the amount of virus in those secretions that are being shed by the infected patient.

Q. The mode of shedding, obviously we understand, I think, sneezing, coughing, et cetera, those things that actually expel fluid from the body, is physical touching of an infected person a mode of shedding?

A. Well, not just touching. It is not thought that coronavirus is shed through the skin. But on the other hand if one had respiratory secretions and you touched those, then your hands would then have respiratory secretions and would therefore be infectious, yes.

Q. Is there evidence to suggest, in terms of the viral load, when it might be at its maximal point?

A. It was thought that you are most infectious just before and at the time of your symptom development. However, technically we usually, in terms of contact tracing and concern about infectiousness, 48 hours prior to the onset of symptoms, for those who have symptoms, and some patients do not, but it is 48 hours prior to the onset of symptoms and then the early phase of symptoms, that's when you are most infectious. That is a similar situation to most other viral infections.

Q. That is to say that one can be infectious but asymptomatic?

A. Correct. Both in terms of in a patient who becomes symptomatic, they are likely to have been infectious for up to two days prior to the onset of symptoms. Then, of course, there are others, which is unusual, a notable feature for this virus, that some patients in fact will either be totally asymptomatic and simply not know that they are infectious, or have such trivial symptoms that they similarly won't consider the fact that they could be infected with coronavirus.

Q. But they could infect other people in a more serious way?

A. Yes.

Q. You also comment at paragraph 19 on the concept of super-spreaders. What is meant by that idea?

A. The concept of super-spreaders is that one individual, for whatever reason, either because they are shedding a lot of virus or because of their behaviour, infect a disproportionately larger number of other, noninfected individuals than one would expect. So in my statement I cite the example that was published in the case of SARS, where it was thought that one individual in fact infected 125 non-infected individuals. This would be disproportionate to what would normally be expected in the average population. So it means that some individuals can have a disproportionately higher impact in terms of infecting others than is usually the case.

Q. In fact, I think you say there are overseas studies suggesting that possibly 10 to 20 per cent of infected people may be responsible for 80 per cent of the infection?

A. Yes. These studies are difficult to perform and obviously to know whether it is exactly the same strain and so forth, but that is the commonly quoted figures, so 10 to 20 per cent, so a small number of individuals can be responsible for a very large amount of the spread, and similarly, some individuals who are infected can really

have very little impact in terms of spreading it to others. The reason for those two things obviously depends partly on how high their viral load is, but also their behaviour. So someone with not necessarily a very high viral load but who had a lot of contact with many others could --- so it is a combination of these things.

Q. You go on to discuss in your statement the proposition of the life cycle of the virus, including the incubation period, recovery time and timeframes in which a person is infectious. Can you talk about the question of the incubation period, from when to when does that run?

A. So it is thought that the incubation period is most commonly up to 14 days, usually only about five or six, maybe seven days, that's the median, but 14 days. There have been some cases which have been defined up to 24 days. But for epidemiological purposes, the vast majority of patients are considered 14 days is the upper limit. Indeed, I guess that's the rationale for isolation and quarantining and so forth, that after 14 days it is recognised a tiny number may have a longer incubation period, but 14 days is a reasonable number to include the vast majority of those who are going to develop symptoms.

Q. Should one develop the disease, is there an average about the resolution time?

A. Well, it's considered that after 10 days after starting --- developing symptoms, that after that period, that you will no longer be infectious. That varies between patients. Obviously some patients are what we usually, for the purposes of release, for instance, back into the community, in the hospital setting, we would want to see patients asymptomatic. In other words, they have become ill, they have developed symptoms then their symptoms have disappeared, we would want to see that they have been asymptomatic for three days before returning to work, for instance. But usually 10 days is the number used. There are some patients who have symptoms beyond that time. It can be difficult because, for instance, if the patient has a chronic lung disease --- lung condition and they always have a cough, how do you determine when they are no longer infectious? So it is really a case-by-case decision after 10 days. If someone is still very symptomatic, with exactly the same symptoms which were unusual and led them to seek advice that they could have coronavirus, we would have concern about releasing them in 10 days, it could go on longer than 10 days.

Q. So, clinically it's a case-by-case assessment?

A. Yes. So 10 days is --- you know, after thousands and thousands of studies --- cases, the 10 days is the reasonable number to use.

Q. You discuss in some detail, and I would like to hear you do so, please, the nature of the body's reaction to the virus and how one actually develops symptoms and how one might resolve as well. You talk specifically about two phases of immune reaction, so I would like you to explain it if you could?

A. Yes. So, like any disease, many of the symptoms are initially caused by the infecting agent, in this case coronavirus. The body responds to the introduction of any foreign element, such as an infection, with a general immune response. Then as the body kind of learns about the character of that infectious disease, it develops a specific immune response in the case of antibodies which are proteins produced by the body that specifically target that infectious agent, as well as other immune mechanisms, including white blood cells. So in an initial situation when the patient first presents, they have these symptoms and it is quite often shortness of breath and so on, so that is initially thought to be largely related to the infectious agent itself, and then in some cases the immune response, whether it is a general immune response, usually the general immune response, that can then cause --- result in some inflammation and that can be part of the cause for symptoms. So as an example, that's why a recent study suggesting that for patients who had presented with respiratory symptoms typical of coronavirus, and then had, after a number of days, continued to deteriorate, it is always a dilemma whether this is predominantly due to the virus itself or the immune response to the virus, the initial immune response. So in this initial study it suggested for patients who were seriously ill and being admitted to intensive care, that actually giving corticosteroids to dampen the body's general immune response can result in some improvement in symptoms. But obviously it is a dilemma because we also know that for those individuals who are on those drugs, let's say, long term where it has a long term damaging affect or limiting affect, shall we say, on their immune system, that they are more prone to getting the infection. So it is a balance between those two elements, and then of course once the body is exposed to this virus and it is able to develop a specific immune response, one expects then the innate immunity, that is, the body learns to recognise that invading agent, in this case coronavirus, and develop both specific antibodies and other immune mechanisms that are thought to be protective of catching a disease a second time. Now, that is not always the case. In some cases that immune response is complete, so an example might be if one had natural measles as a child, it is likely that for the rest of your life you will be immune to catching measles again. But in other viral infections that is not the case. You develop antibodies and those antibodies are what we call non-neutralising, that is, they do not protect you sufficiently to stop you getting sick again with a second infection.

Q. Is there, as yet, reliable evidence as to whether a person infected with COVID-19 who resolves, presumably by acquiring the sort of immunity you say, can expect not to be infected again?

A. It is unclear at this stage. It is thought that by --- and in fact, it is the principle of vaccination, of course, and immunisation, that by developing antibodies and these other immune responses, that will protect you in the future. But there have been a number of specific examples where individuals have clearly had the disease, recovered and then some weeks later become ill again with the same symptom complex. What is lacking in this is the clear evidence that indeed was it exactly the same strain that they caught the second time or was it a slightly mutated strain and they caught a second strain? That is unclear. Nevertheless, it is obviously the basis for the various vaccine development studies, is that by developing a suitable vaccine,

that that will provide, allow --- the point of the vaccine is for your body to learn to recognise, in this case coronavirus, develop immunity to it, so that when you actually get exposed naturally, that you have already got that specific immunity and you either won't become ill at all or your symptoms will be markedly reduced.

Q. The principle of vaccination is to introduce enough of the virus into your body to develop the immune response but not sufficient to make you sick?

A. Usually, it's key components of the virus rather than the virus. Either the virus has been deactivated or neutralised or it is key components of the virus which it is known the immune system responds to. In other words, you are just exposing the body to those key components, you don't have to see the entire virus, just, let's say, the outer capsule or the outside of the virus, for instance, to trigger that immune response. So that is the principle. Obviously there are a large number of vaccine companies all developing slightly different vaccines with different modes of delivery, of either the virus or components of it, and also what alters is how many boosters you require to maintain adequate immunity for a prolonged period and so forth. That is the principle. Each virus and each disease in fact is quite different in this regard and that's why vaccine development is an interesting field, but also quite complicated and it requires a clear understanding of the disease.

Q. Thank you. We also asked in the witness statement for you to comment on the concept of R_0, which one hears about in the media reasonably frequently those day. Can you explain to us that concept, please?

A. Yes. So the R_0, as I mentioned in my witness statement, is really about the community at large. If on average across a community --- and one would have to define what that community is, so for example there is an R_0 value for the whole of Australia, and then there is a separate one, let's say, for the Victorian population, but across a community, that if any infection, if the R_0 is 1, then on average one person infects one other, so the disease remains in the community. If it is less than 1, then on average across that community each individual is infecting slightly less than one person, so that means that gradually the transmission within the community will decline. Obviously this varies a lot because as we just discussed with super-spreaders, you can have one individual who infects a lot of people and some others who hardly infect anyone. So the R_0 is an overall figure for the entire community, rather than reflecting one individual.

Q. So it is a function of the infectivity of the virus and human behaviour and intervention in the community?

A. Yes. As an example, measles is a highly infectious virus. It has an R_0 of 12 or 14. But you can truncate that naturally high transmission risk with a virus like measles by altering human behaviour so there is less contact between infected individuals, and so you can contain the virus, or you can vaccinate obviously against measles, which is the way we usually do it. So the R_0 is a reflection of both the nature of the virus and also the behaviour of those who are infected and whether their

behaviour enhances the risk of transmission.

Q. Thank you. Could I now ask you about the question of modes of transmission of the virus which you deal with obviously in your witness statement. Can you take us through the various modes which are understood to be the modes by which the virus is transmissible?

A. Yes. So because this is predominantly a respiratory virus, respiratory secretions, whether they are upper or lower respiratory tract secretions, get the most common means of transmission. In terms of --- well, in the case of COVID, it is mostly thought to be transmitted through droplet spread, that is, relatively large respiratory secretions, 5-10 µm. There is a question about airborne transmission, perhaps I'll come back to that. But obviously in respiratory secretions --- so that is one means, in terms of someone inhaling, directly inhaling those respiratory droplets because of the close contact. But also, of course, those respiratory droplets can lead to contamination of surfaces and then you can touch those surfaces or indeed bypass all that and just touch your nose or your mouth where the respiratory secretions are, and then you have the infectious agent on one of these --- either one of these surfaces or on your hands and we call that fomite transmission. So it is a non-respiratory --- it started with a respiratory spread, but has then contaminated nearby areas or indeed your hands or clothing, and that can then result in further transmission, if you were then to touch your --- your hands were contaminated and let's say you were to pick up an object which had an infectious virus on it, your hands would become infectious, and then you were to touch your own mouth our rub your eyes, you could infect yourself from your hands or from other objects. Clearly, in the hospital setting, for instance, shared pieces of equipment would be another means by which, if they were not cleaned adequately or had been used by multiple patients without being adequately cleaned, that could be a means of transmission also.

Finally, there is virus in faeces, but to date there has not been any transmission reported of faecal oral transmission, just because of standard health precautions, I guess, with faecal waste.

To come back to respiratory transmission, it is thought with coronavirus that it is predominantly droplet-spread, but there is the potential of airborne spread. So with droplets we expect the droplets, being larger, to fall to the ground close to where they are expelled from infected individuals, so within a metre usually and that's the logic behind social or physical distancing at 1.5m to 2m, so you are clear of that. However, we know that certain procedures and certain actions can expel droplets that are smaller than that and depending on whether you use the World Health Organisation definition where they call it "droplet nuclei" to indicate smaller droplets of respiratory secretions, that they can be transmitted a greater distance. In a hospital setting, for instance, there are certain procedures where intubation, for instance, where you are putting a tube down into the person's lungs, that clearly place you at higher risk of what we call airborne transmission, or at least beyond the 1m radius, and it is for that reason that extra precautions are taken when undertaking those procedures. There has been a number of social --- the question of airborne

transmission is very important because we know, for instance, in other viral infections such as measles, that that can be transmitted through air-conditioning systems and so forth.

With coronavirus, initially it was considered that this was very, very unusual, but subsequently there have been certain circumstances where well-described outbreaks have occurred, not so much through air-conditioning systems but closed spaces, such as at choir practice and in fitness gyms and things like this, where obviously people are, maybe not coughing, but their breath contains small droplets and it has spread to others, even though they would be outside the 1.5m area.

If, however, for coronavirus, if it were sufficiently --- airborne transmission was a high likelihood, as with measles, we would expect to see outbreaks in office blocks and other facilities where there's air-conditioning, where often some of the air is recycled. And we have not seen that. So I think everything is a spectrum. In the case of coronavirus, the dominant means of transmission is through droplet spread and hence physical distancing and mask use and so forth, but certain activities can lead to at least a wider radius of airborne transmission but the likelihood of it being through air-conditioning systems, at least based on epidemiological grounds, seems unlikely. Just this last week there has been an interesting study published showing there can be some degree of airborne transmission, but from epidemiology grounds it seems less likely; I'm not saying it doesn't occur, but it is not the dominant means of transmission.

Q. Could I just clarify, in terms of the droplets that you say are larger and heavier, they are likely to fall to the ground within the magic 1m radius or 1.5m and therefore be less of a problem if you are 1.5m away?

A. Well, unless you touch those areas, of course.

Q. Yes. In terms of the droplet nuclei, they are the ones we are referring to as "airborne"?

A. Yes.

Q. That is to say, they can remain suspended in the air?

A. Yes. And so it really depends on the size of those droplet nuclei as to how far they would be transmitted. And the conditions. I mean, for instance, if you are in a room with hardly any ventilation, then that would be different to a room that was highly ventilated.

Q. Yes. Can we go back to the question of what you called fomites. That's the mode of transmission whereby if some infected droplets or particles fall onto a surface, they actually survive on the surface and are infective?

A. Yes.

Q. And does that vary according to what sort of material we are talking about? Do we understand the science of that?

A. Look, it obviously depends on being able to culture the virus, so that's --- it's thought with coronavirus that they can last, there have been some studies suggesting they can last on cardboard and stainless steel and plastic for up to 72 hours, so it varies with the virus. Some viruses can last longer. Also, the conditions of that obviously vary. Just recently with the recent upsurge in New Zealand, the thought is perhaps it has lasted longer than that time because of specific cold conditions. But in general, where we are talking about going into a ward or a quarantine facility, 72 hours is the upper limit of what has been detected or considered to be a reasonable timeframe.

Q. You touched on the question then of climate. Again, is there any reliable data to say that the virus is more active in hot or cold climates or is the jury out on that?

A. Currently I think the jury is out because it is clear that --- there has been a series of outbreaks in abattoirs, which are cool environments. But the trouble is that they are also close working conditions in those environments, in many cases. So we are learning about the virus as we go. But at the moment it is not --- one would also say, similarly, that during winter does the virus appear to spread more commonly? But in winter we are often inside in closed rooms, so transmission is potentially higher in that situation, so I think the current situation is it's unclear.

Q. Do I take it that social behaviours in cold and warm environments change so much that that would tend to confound it anyway?

A. Absolutely. So obviously during warmer climates people tend to be outside and naturally socially distancing, rather than being huddled around a fire or being inside. So these things make it complicated in terms of defining or deciding whether the temperature, just on its own, is a major feature in the spread of coronavirus.

Q. Acknowledging the particular features of coronavirus that you have already described, what is your view about whether or not such a pandemic was a foreseeable event?

A. Look, pandemics, maybe not coronavirus, but pandemics have been considered for a long time and as I have put in my witness statement, both Federal and State Governments and indeed most countries have been preparing for a pandemic. Clearly, since the 1917 flu pandemic, influenza being commonly with us, has been a dominant focus of those pandemic plans. That is perfectly fine in terms of coronavirus because it is just another respiratory virus. Obviously with influenza we have the advantage that there are now some drugs that we can use to treat that. But many of the components of the pandemic plans, whether it is Federal or State, are equally applicable to coronavirus. There has been planning for pandemics well entrenched in all health services in Australia.

Q. To your knowledge, do the plans contemplate the idea of large-scale quarantine level?

A. Well, in both the National and the State plan, quarantine is discussed. The size of it is not something that has been --- that I have been able to detect. It's always referred to without there being a clear outline of what would happen if there was a quarantine of 10 people versus 10,000 people. The details of that have been not teased out, it's a general --- in each of the plans it's been largely a general discussion about quarantine. And the principles of quarantine are kind of well known but what you are talking about is scale and that is not something that has been a dominant feature of the plans, no.

Q. To your knowledge, has there been any specific planning in respect of the sort of Hotel Quarantine Program such as we are experiencing in Australia at the moment?

A. Not to my knowledge. In the published plans, no.

Q. Could I ask you, then, about the notion of quarantine and isolation so that we have a better understanding of what those concepts really mean?

A. Yes. So isolation is the physical separation of someone who is infected from those who are uninfected to stop transmission. The difference between that and quarantine is that you are actually enforcing restricted movement of the individual who is either infected or potentially infected. It is an enforcement function. Of course, throughout history, quarantining has been a crucial public health intervention. There have been quarantine stations present in the past where there is enforced physical distancing and restriction of movement of individuals who are either infected or potentially infected. When you come to hotel quarantine, the key word is "quarantine". "Hotel" is just a description of the geography, of the site. So, quarantine, the principles of quarantining remain regardless of the site.

Q. At paragraph 54, for your reference, you deal with those basic principles. Can you speak to that, please?

A. So it's about keeping those patients or individuals who are either infected or potentially infected physically separated from others so that neither through droplet spread or airborne spread or fomite spread, that they are going to infect others, either those caring for them or other individuals who may be suspected of having infection but indeed don't have infection, stopping them acquiring infection from the person who does have infection.

Q. Does it involve the idea of quarantining infected people from other infected people?

A. Yes.

Q. Because?

A. Well, those who are uninfected can then obviously become infected, so if you were to mix the two then the chances of uninfected becoming infected would be markedly enhanced. Obviously where it becomes complicated is in the case of suspected, let's say, coronavirus cases, where taking individuals who have some symptoms suggestive of infection and we are keeping them separated from others who also have some symptoms suggestive of infection, until we sort out who is infected and who isn't, and then removing them from that situation. But the presumption in the case of whether it's isolation or quarantine --- but particularly quarantine, the assumption is anyone entering quarantine is just assumed to be --- from the point of view of control measures and quarantine measures, the assumption is anyone entering quarantine is infected until proven otherwise.

Q. What I wanted to understand is whether in the quarantine environment, you would quarantine infected from infected as well as the noninfected?

A. Yes, you would have to be extremely --- normally, if you are dealing with a ward of only those who are infected, even then we usually try and keep them separated from each other just in case they have a slightly different strain of the infection, from each other. In some circumstances, obviously that's not possible, so we attempt to cohort, that is, we cluster known infected cases together, where as best as we can tell they have an identical infection and so they are not going to pose a risk to each other. But they are always optimally kept separate from each other if possible.

Q. Coming back to the environment of the Hotel Quarantine Program and COVID-19, from an infection control point of view, what is your view about the desirability of testing people?

A. I believe that testing people is sort of really crucial for coronavirus because such a large proportion, relatively speaking, maybe up to 20 per cent or so, maybe more, can be asymptomatic, and particularly in younger people. So if you were to only rely on symptoms, you would potentially miss some infected individuals and you would treat them as uninfected when instead they should be treated as infected, even though they don't have symptoms.

Q. Could I follow that by asking, if you allow a 14-day period and someone is untested and symptomatic, what is your view about the appropriate method then?

A. Sorry, could you repeat the last little bit again?

Q. In the event that someone has completed a 14-day quarantine, hasn't been tested and is symptomatic, what is your view about the desirability --- from an infection control point of view, how should that person be treated, do you think?

A. Well, they are symptomatic, or they have suggestive symptoms, they should be tested and find out whether they are positive or negative. I mean, of course, it could

be another infection altogether causing those symptoms. But if you weren't to test those individuals, then from an infection control point of view, in the current pandemic situation, you would need to assume that they were indeed infected with coronavirus and treat them as such.

Q. Can I ask you to talk to us a bit about, as you say in paragraph 59 of your statement, the range of personal protective equipment that is deployed in hospitals, at least obviously, and then we might talk about specific contexts or specific uses of material. If we can start with the range of possible personal protective equipment and then we will move to the context in which they are used.

A. Yes. So if we --- we have just discussed the means of transmission, so clearly, a mask is crucial and the quality of the mask is important, depending on whether you are likely to be exposed to simply droplet spread or whether there is a possibility of airborne transmission. So a level 2 surgical mask is considered adequate for prevention of inhalation of droplets. But if you are doing an aerosolising procedure, that is something that is likely to lead to smaller droplet nuclei, such as in a medical case of intubation or CPR, then you should wear an N-95 mask. A surgical mask filtration is considered adequate for the larger droplets, but for the finer droplets, what we call an N-95 or a P2 --- they are separate names for the same thing --- is required. Obviously, also as I mentioned, the virus can be transmitted through conjunctiva and the mouth. So the mouth is covered by a mask, but for your eyes, you should have either goggles or safety glasses and in some cases we would also wear face shields to protect the whole of the face because we know, as humans, we often touch our face with our hands and that can pose an extra risk.

Then to stop your clothes becoming contaminated, either from someone coughing on you and spreading droplets or airborne, so you wear a long sleeve gown. Usually it's a single-use disposable gown which covers your arms and most of your body. Then of course your hands are a key means of transmission, either from contamination from respiratory droplets and viral particles or from touching what we call fomites, you know, infected objects, and so a minimum would be the maintenance of very strict hand hygiene, either using soap and water or hand washing or alcohol based hand rub of an adequate quality product. But ideally, if there was very direct patient contact, the standard in hospitals, at least, is to wear disposable non-latex gloves and to change them after each patient contact.

Q. Yes.

A. Sometimes, you know, in hospital settings and other settings things aren't as predictable, so an individual may approach --- a staff member may approach a patient not expecting to have direct contact not wearing a pair of gloves, but in that situation you always expect them to do good hand hygiene immediately before and immediately after any unexpected contact.

Q. Can I take you to then to the associated idea of the training in the use of PPE, if I can call it that, even accepting that it might change by context. Can you speak

generally to the idea of what is needed to train someone to understand the use of the equipment you have just been describing?

A. Yes. The training in PPE is really, really crucial. As an example, just putting a mask on and taking it off, if you handle the front of the mask as you are taking the mask off, the whole point of the mask is it is preventing infected droplets entering your respiratory symptoms, so if you touch the outside of the mask rather than just touching the straps at the side, then your hands will now be contaminated and you will be --- potentially infect yourself. So what we call donning and doffing, that is, putting on and taking off PPE, whether it is the mask, the goggles, the gown, and hand hygiene before and after, or the doing, the sequence of this is important. It is actually quite a complicated thing, even as an infectious disease physician, to remember how to do it accurately. It is for that reason that, at least at the Austin, we developed a training video, because you can read signs and instruction leaflets all you want, but actually nothing quite replaces the visual side of things. Then on top of that, having someone actually observe you putting on and taking off PPE, to say, "Oh, you forgot to do this" or "You should have done it that way."

So there are really sort of written instructions, visual instructions, ideally, then --- you now hopefully have acquired some knowledge but you also need that step of ensuring that that knowledge can be accurately turned into correct practice. And so it requires someone to watch you doing that. Indeed, up in our COVID wards and SCOVID wards, people get tired and so there may be a risk of some lapse in the strictness of this. And it is up to each staff member to say, hey, you forgot to do this, so there is ongoing observation not only of trained staff initially and on a regular basis, but also your co-workers. It is a crucial role --- just to have PPE but to do it wrongly is a risk. For people who are working in our coronavirus wards or suspected wards, all of them need to be a little scared. If they are not scared and not paying attention to this, problems can arise.

Q. You are talking perhaps generally in a treating environment. What, for example, would you say is the need for training and PPE, say if someone presents at a clinic thinking that I might be --- "I might have COVID, I've got a cough", et cetera, and someone behind the counter is to take their details and ask them to take a seat or that sort of context, is PPE called for, training called for?

A. Yes. It is an important issue, perhaps early in the disease as we saw in China, where they weren't suspecting coronavirus, but that's a key component of the structure in which we do health care now, that anyone who has any suggestive symptoms, that they go to a specific screening clinic where the staff, right from the very beginning, are assuming a patient could be infectious and they are taking all the same precautions as if they were infectious. Clearly, there can be occasional lapses, but the whole structure, at least in hospitals and any, let's say a quarantine facility where the assumption is that the person is infected until proven otherwise, and that's sort of the scenario that you are painting there. So that comes down to a physical structure such that anyone who has symptoms or suggestive symptoms should be channelled into an area where they can be safely investigated.

Q. If I were the person behind the counter taking down the details and seeing if the person has an appointment, that sort of thing, should I be using PPE?

A. Yes. Obviously, there can be physical barriers, such as perspex screens and so forth, but really, that individual should ideally not be in that area, they should be going to an area such as a screening clinic, but there are some general physical barriers that can be put in place for that, in case someone slips through the cracks, but it is not the ideal. So increasingly, as an example, speaking specifically about the Austin, this is the reason we have now gone to a whole of hospital, everyone wearing a mask, simply because to avoid any inadvertent exposures where they haven't entered a controlled environment.

Q. For the purposes of preparing your witness statement, did you actually undertake a training module supported by the Australian Department of Health on infection control?

A. Yes, I did. I got a perfect score.

Q. I would hope so. But so did I. It doesn't mean much.

I wonder if we could see that on the screen? Perhaps whilst we are waiting, it is a module that is said to take about 30 minutes to do and it consists of slide and embedded video?

A. Yes.

MR NEAL: I should say, Madam Chair, the particular relevance of the document means that it is the particular form of training that is required under the head contract between a government department and security companies, requiring that the security company personnel complete this module as part of the contractual requirement for attendance on site. I want to be clear, it is the particular requirement, there is a more general requirement for training, but that is not specific. This is the only document that seems to be specific.

This is the module that you undertook, Professor?

A. Sorry, could you repeat that?

Q. This is the training module that you recognise --

A. Yes. Yes.

Q. --- in that slide form. Could you comment generally on the training module, assuming in the first instance that the person who is undertaking the training has no particular training in infection control?

A. My assessment of this training module is that it is hard to know who their target audience is. Elements of it, indeed, the majority of it, is like a training module for the general public rather than someone who is going to come into direct contact, or indeed, be responsible for managing COVID patients. The vast majority of it is --- in fact, when I did the module some time back, I had assumed, just by the way it was structured, that this was really as a sort of a community education about infection control rather than a specific document related to staff of any sort who would be directly managing potential cases.

Indeed, when it came to the crucial section about PPE, there was no information other than to seek advice from your local authorities. So it was a general document, including food handling and looking after your family, as well as then other slides which appeared to be slightly more targeted towards health care professionals or potentially, I guess, quarantine staff. But I would describe this document as confused in its target audience and the level at which it pitched information and the detail with which the information was provided.

Q. The module has a teaching component and a test component, to which you I think referred. Slide 64 of the module asks the question:

Everyone should be wearing a mask to prevent COVID-19?

If you enter the answer "True" --- could we see the next slide --- you see that you are told the answer is wrong. The one way to continue is to tick the other option.

A. Yes. So do you want me to comment on that?

Q. Well, you can, yes.

A. Well, I think this is a good example of why training --- this video is confusing, because at the time if it was targeting the general community, those who are not specifically looking after potential COVID patients, the general policy at that time, earlier, until recently, was that not everyone did have to wear a mask. Of course, in Victoria now, we all do. So the context to this question now is incorrect, of course, because in Victoria we are all wearing masks when outdoors or within any potential contact. But I think clearly this is misleading for health care workers or quarantine staff if they thought they didn't need to wear a mask, when I would consider it crucial if they were in likely contact with a potentially infectious patient.

Q. Do you recall the date on which you did the test?

A. The version I did was back in July, and I believe it has changed slightly since that date. Perhaps you could --

Q. Yes.

A. I did this version earlier, when it was like this, yes.

Q. Could we go back to slides 26 and 27, please? What you are seeing there, is that what you saw when you did the test?

A. Yes. I mean, the first dot point obviously gives you the answer to what, at that time, was deemed to be the correct answer.

Q. Okay. At the time that you did it, what did you think about it as a reliable piece of information?

A. Well, it's --- at that time it was reliable for the general community but completely inaccurate for anyone undertaking health care or potentially at risk with --- you know, quarantine staff, with an infectious patient. It was the complete opposite of what we teach regarding PPE. So that's why my assessment was that, at the time I did this, this was a general information module about general infection control measures out in the community where you were just going about your daily business, not where your job was actually to care for potentially infected individuals. As an aside, I think it's --- I agree with the general use of wearing masks as a preventive measure. So even given the policy, I disagreed with the policy, now I agree with the current policy, it just makes sense and there's clear data in a number of very reputable journals that wearing masks is a key prevention measure to avoid any infection with coronavirus.

Q. Can we call up the current version of the same slides, please? I had understood we had slides 26 and 27, which covered the original and the amended version of this.

Have you seen a different version of the same slide?

A. Yes, I have since, the updated version.

Q. Perhaps we won't detain you on that just for the moment.

I want to then take you, in relation to PPE and training, and talk about specific contexts in your workplace at the hospital, the variety of physical contexts in which people who may have COVID are treated, how they are segregated, if you like, in the hospital and the sorts of equipment that is applicable to each. You deal with that at paragraph 68, but if you could speak to the various settings. You started off with the screening clinic.

A. Yes. Obviously in the hospital --- well, we have the screening clinic where individuals who are either --- have got symptoms such that they are worried they already have symptomatic coronavirus, or they have been exposed to an individual or they are just worried for whatever reason, and in that screen clinic all the PPE is on the assumption that they could be infectious and the registration and taking of the specimens and so forth is based on the fact that they are positive until their results come back, or the way we manage the patients.

Then through to hospital admissions, where either their test result has come back and they have deteriorated so they would go to a specific COVID ward, that is, where all the other patients in that ward have coronavirus, or more commonly, they would go to what we would call SCOVID, namely they have --- as I put in my witness statement --- they have come in with some other problem, let's say a broken leg, but they have some respiratory symptoms and we simply can't be sure that they don't have a broken leg and early coronavirus, so they are put in suspected COVID precautions. Once again, they are treated as though, from a PPE and infection control point of view, as though they are infected until we find that their test is negative, in which case they go out to the relevant unit, having been shown to be negative.

The second category, as I listed, so-called asymptomatic patients, where someone has come to hospital with a particular medical condition but they have come from a high risk background. So let's say they were a patient in a nursing home where we knew that there were many other cases of coronavirus, the patient didn't have any symptoms but we were concerned that there was a high prior likelihood that they could be incubating coronavirus, so they would be put into a quarantine area, kept away from those that are symptomatic, but treated just the same in terms of they are now in their 14-day quarantine period, in case they develop coronavirus symptoms or develop symptomatic coronavirus during that 14 days.

That's based on information as to their likely exposure, if you like, whether it's in a nursing home, aged care facility or whether someone fell and broke their hip but every other member or many of their family members were known to have coronavirus, we would be concerned that they could also be incubating it. So what we would call SCOVID asymptomatic, if you like, they are treated as though they are potentially incubating and with all the same behavioural elements and PPE elements as though they're --- by the staff, right through, then, to patients proven to have coronavirus. They are nursed in a separate area, and then through to the ICU, where there is an extreme --- they are obviously very unwell. The risk of airborne transmission is increased and basically the difference, as I described in my witness statement, is you're around the type of mask that's been used in those different situations and the rigour, and in very extreme situations, like in ICU, where someone is deteriorating, they're known to have coronavirus, and they are about to be intubated, for instance, that is a tube put down into their lungs, well, that is an incredibly high risk activity by the anaesthetist to perform that, to connect them to a ventilator, high risk in terms to the anaesthetist, and there are additional precautions taken in that situation.

Q. You mentioned in relation to what you are calling SCOVID, the suspected COVID but asymptomatic, that if those people were tested that they remain in quarantine until they are tested. What do you mean by quarantine in that context?

A. They are nursed in a single room where they can't leave without being --- you know, certain precautions being taken, so they don't potentially spread virus through the hospital. At the very minimum they are tested at baseline and then usually just

the same as anyone else, they would then be tested at day 11 or so, so that the results would be through in time for day 14. And if the day 11 test and day 14 they are still asymptomatic, we would deem them as not having acquired coronavirus and they would be released to their relevant unit. If they had a broken leg, they would go to orthopaedics, if they had liver failure, they would go to the liver unit.

Q. We might take you back to the slides. Slide 25 might be the new version of the masks?

A. Yes.

Q. Do you want to comment on whether, on the basis of current understanding, that that is appropriate advice?

A. Yes, it is in one sense. But this is where I mentioned I believe it's confusing. Firstly, dot point 4 should really be dot point 1, namely, if you are sick, put on a mask so that you don't infect others. I suppose, knowing a bit about education of infection control, it's also a little tough, in that dot points 2 and 3, it requires the individual to know whether there's local COVID transmission or not. I'm not sure that many in the general public would necessarily know that. Obviously in Victoria it's been well-publicised that there is community transmission, but I think this is --- well, my assessment is that I think this is unhelpful. It could be better targeted to and explained.

Firstly, the first take-home message is if you are sick, then you should go and seek help and put on a mask, and indeed, that's what we do when someone turns up to a screening clinic. The last dot point is true, that using a mask, doesn't --- is also correct, but where there is no local transmission, using a mask when you are out and about in the community is not necessary. That was a policy at one time, obviously that has now changed in Victoria, because it is deemed that there is community transmission. But even in those areas where there hasn't been documented community transmission, some regional areas of Victoria, it's now a policy that people should wear a mask when they are out and about.

So I guess, to be honest, if I was just in the general public, I would be a little confused by this. The order seems out of sequence to what we know for sure. That is, wear a mask if you are symptomatic, and then it requires you to have some understanding; whereas most messaging should be crystal clear for people of various levels of education and understanding, let alone whether English is their first language.

CHAIR: Mr Neal, just for clarification for the transcript, are you able to date that document that's now on the screen?

MR NEAL: To the best of our knowledge, what was called the original was current to 25 July, in the sense that it was in the original form on the 25th. I can't say exactly when it changed from that.

CHAIR: It is post-25 July, is best that you can do?

MR NEAL: Yes.

CHAIR: Thank you.

A. Could I just comment? I guess the other thing is we looked at the answer to that question earlier, where it said you don't have to wear a mask. I'm not sure how you would answer that question based on this slide now.

MR NEAL: Okay. I think I was interrupting you in explaining how the various levels of COVID are treated within the hospital. You told us about the screening, you have told us about the suspected COVID, either symptomatic or asymptomatic, and then it escalates to specific COVID wards ---

A. Yes.

Q. --- for people who have tested positive and then to ICU for people who are very sick with COVID?

A. Yes.

Q. You say from paragraphs 70 and onwards about PPE in relation to those various levels of the hospital, if I can call it that. Can I ask you to speculate what would be the analogous level in the hospital to people in a hotel, in a quarantine hotel, who are patrolling corridors, taking food trays, bringing in deliveries potentially, handling luggage for people who are in quarantine? So taking it a little away from the "treating environment" into the environment which we understand was prevailing in the quarantine hotel, and ask you perhaps in relation to, say, patrolling a corridor where there may be --- there are people quarantined who may be COVID-19 positive, if we could start with that. What sort of precautions then would you have for such people?

A. Well, they would be the same as for a SCOVID asymptomatic group. That is, the thing that --- the issue is the unexpected. So if someone --- if you are patrolling a corridor and people are meant to be in their rooms but they suddenly exit their rooms, then you should be in the appropriate PPE that is consistent with contact. So at least a gown and mask and at the very minimum rely on hand hygiene, but if there was a chance that you were going to have direct contact with, say, you were picking up a tray from outside, that tray could be infected with --- contaminated with infectious material so you should be wearing gloves, but at a minimum, at least alcohol rubbing before and after contact.

I guess it is also complicated by the fact that the patient may not yet be symptomatic but in 24 or 48 hours be symptomatic, so that period would still fall in the --- the fact that they are well today doesn't mean they're not going to be unwell tomorrow. So

those precautions would be equally applicable. So in --- obviously restraining the patient or having the patient for certain know --- if you are certain they are going to stay in their room and there is no other contact, but that's not really the situation of quarantine. The situation is meant to be that you are prepared for the unexpected and the assumption is that the person is infected, potentially infectious.

Q. Is there any relevant difference, for example, if you are required to escort a person who is in quarantine outside for a fresh air break, in terms of PPE?

A. Once again, my view would be that the staff members should be prepared for potential exposure and their PPE should reflect that. Indeed, if you consider previous quarantine facilities, such as we had at Fairfield Hospital when that was open, or quarantine stations for other diseases, tuberculosis and so forth, that was the mantra for any health care workers, that they were always, until there was spatial separation --- but also that the health care workers followed PPE rules, on the assumption that something unexpected could happen, and so if you were escorting someone out to, let's say, exercise, then there is the potential that whoever is doing that, something unexpected could occur and if you weren't wearing the appropriate PPE, then you would be at risk of being exposed.

Q. Is it fair to say, then, that your analogy with what you understand of the hotel quarantine environment is with what you call your SCOVID category, in terms of PPE?

A. Yes. SCOVID --- well, exactly, SCOVID, whether it's asymptomatic or symptomatic, the PPE requirements would be similar, in my view. I said initially, this is about quarantine. Whether it is in a hotel or anywhere else, the principles are meant to be the same.

Q. You did mention the instance of being required, for example, to take away a food tray or food packaging and either the use of gloves or proper hand hygiene. If you were wearing gloves in that instance to take away a tray or some food packaging, what's the proper protocol, having done that?

A. To discard the gloves as soon as --- you pick up the tray with gloves on, so alcohol rub before putting the gloves on, put the gloves on, pick up the tray, deliver the tray to, presumably, a secure area where it would be appropriately handled subsequently, and then dispose of the gloves, and alcohol rub again.

Q. Can I take you back to your workplace at the Austin. Does the Austin make use of security guards?

A. We have security guards outside the COVID and SCOVID wards. So in other words --- their only role is to ensure that people do not enter unless they are --- well, let me go back a step. There are obviously two sorts of security guards; there's the hospital security group and they have specific training both in terms of security, but to work in the hospital they have undergone specific additional training in terms of

use of PPE, the same as the nursing staff or doctors would, but also in their role as security, for many other things other than coronavirus, there's obviously training in terms of de-escalation and physical restraint if need be and all in a medical context. So their training, let's say, we were talking about PPE, is just the requirements are the same for them as for other staff.

Q. In the hospital environment where you have people in quarantined in the confined to the room sense that you mentioned --

A. Sorry, repeat that, please?

Q. In the hospital environment where you have people confined to a room, as it were, quarantined in a room, are there instances where people don't cooperate?

A. A lot of the time, yes. I mean, remember that for many of those people they have come in for another reason. If we are talking about so-called SCOVID asymptomatics, they have come in for another reason and they can be confused for another reason or have a medical condition that makes them not follow rules, so that's why kind of preparing for the unexpected and finding a patient leaving a room and wandering the corridor, that that is part of the process of ensuring quarantine, that there are staff available to restrict that. There are also planned times when patients need x-rays and CAT scans and things like this, so the patient would wear a mask and they are taken down by a staff member in full PPE to get those tests undertaken.

But to come to your point about patients often leave the rooms, it varies with the condition. Of course, for most --- in many cases, the patients are sick and are happy to stay in their room, but others, they become agitated and that has to be dealt with and there's a sort of de-escalation strategy with that and in many cases they would be --- if they need to get out --- a common scenario would be someone who wants to go out for a smoke and we have a non-smoking policy, but on the other hand in that example would be that to deescalate the situation, a staff member would take them to a restricted area where they could do that without exposing anyone else in doing that. But that's all part of the planning process.

Q. I will stop you there. We still have the mask slide up. We don't need that any more.

If the Board pleases, can I tender the slides and have them now taken down?

CHAIR: Do you want both of those as Exhibit 3?

MR NEAL: Yes, thank you.

CHAIR: They are part of the same document, albeit updated, as I understand it.

MR NEAL: That's correct.

CHAIR: Exhibit 3.

EXHIBIT #003 - SLIDES

CHAIR: I understand that document is to be taken down, please. Thank you.

MR NEAL: Professor, in the context of people, let's call them non-compliant in quarantine, who are the first responders if something like that occurs?

A. It's usually the nursing staff or medical staff, but usually the managing nursing staff and then if a patient --- if it's deemed that they are becoming sufficiently agitated, then one of the security staff will be called, really as much as anything for an additional presence but also to reinforce the importance of the messaging about staying in the required area. And only in rare occasions would the security staff be required to actually physically intervene or do anything further than that. But in doing that, when they arrive, they would be in --- in the example you have chosen, where the staff would be in PPE, then the security staff would get into PPE also. Once again, it is all based on the assumption that the patient is potentially infectious.

MR NEAL: If the Board pleases, there is a series of questions which I have agreed to put to Professor Grayson beyond his witness statement. It might be a convenient course, given the nature of the evidence that he has given, if I have the opportunity of consulting with those who are wanting those questions answered, to see to what extent they actually need to be pressed now.

CHAIR: Do you want to take a short break for that purpose, Mr Neal?

MR NEAL: Either that, or if the Board pleases we could adjourn.

CHAIR: I could leave the hearing room. Would that be of assistance?

MR NEAL: Yes, that would work, thank you.

CHAIR: Professor Grayson, I'm not sure if you understood that exchange. Mr Neal is just indicating he needs to confer with one of the legal representatives who has been granted leave to appear with respect to some questions potentially for you. For that purpose, I will leave the hearing room.

I'm not sure, do you want also Professor Grayson to be removed from the hearing room too, Mr Neal?

MR NEAL: I would appreciate the opportunity of just a consultation with a member of counsel.

CHAIR: All right. Professor Grayson, both you and I will have both our cameras and microphones stopped whilst that transaction is taking place. I'm assuming Mr Neal is only requiring a few minutes.

A. Okay.

MR NEAL: I'm hoping so, your Honour, yes.

CHAIR: We will do that just for a few minutes. Thank you.

ADJOURNED **[12.48 PM]**

RESUMED **[12.55 PM]**

CHAIR: Mr Neal, I notice it is 12.55. I wonder if the appropriate thing to do is to take the lunch break now and allow you and Mr Moses to have the discussions that you need to have and, if that is convenient to Professor Grayson, we will come back at 2.00?

MR NEAL: Yes, I think that is a sensible course, with respect.

CHAIR: That is what we will do. I will take the lunch adjournment now and we will return at 2.00 for any remaining questions of Professor Grayson. Thank you.

ADJOURNED **[12.56 PM]**

RESUMED **[2.02 PM]**

CHAIR: Professor Grayson, I think Mr Neal had a few more questions for you and then Mr Moses. Is that right, Mr Neal?

MR NEAL: Yes, that's correct.

Q. Professor, I have some supplementary questions that aren't specifically dealt with in your witness statement to put to you, around a number of topic areas. The first of those is best practice designed for a quarantine program in a general sense. The first specific question under that rubric is: what may be the limitations of a hotel, in design terms, as a suitable location for the purposes of infectious control quarantine?

A. Obviously it depends on the hotel, but the general principles for quarantine would be that there was the ability to totally separate potentially infected patients or people

from those who are not infected, so obviously single rooms with their own bathroom, so that there was no need to share bathroom facilities. There would need to be sufficient open area space, so the physical distancing could occur at all times, should two people who are in quarantine --- that they don't come too close to each other, and that would include areas like the lobby and other spaces, so there would have to be room for them to be spatially separated. There would be an area for the staff members who are caring for the people staying in quarantine would need to be looked at, so that they had adequate space and that the areas they were sharing were not too small or limited in ventilation. Ideally, the exercise area for people in quarantine should be, if you like, policeable, so in other words that there was no intermingling when people were out exercising or getting fresh air, that there was a risk of them coming into contact either with each other or with others in the community who may be uninfected, otherwise you lead to exposure.

Then finally, for --- it would depend on whether the hotel is for those with proven or unproven --- obviously, if someone has proven --- well, in both categories there needs to be concern about the air handling. In a hospital setting, all patients aren't necessarily in a negative pressure room, but there needs to be adequate ventilation so that, ideally, there's not a lot of recirculation of air, just in terms of airborne spread, but on the other hand that would be most relevant of patients who were very symptomatic, where there was a lot of coughing and we discussed that earlier, about potential for an extremely symptomatic patient to create some --- the risk of airborne transmission, albeit unlikely as a means of transmission via the air-conditioning system, but there would need to be some attention to that, I guess. In particular, if the hotel was being shared between quarantine people and routine hotel guests also, which falls into the category of uninfected or not likely to be infected.

Q. In terms of best practice, again, what do you say about how staff who are commencing a shift and leaving a shift in an infectious disease ward would appropriately behave?

A. Well, When they are starting a shift, there would be ideally the appropriate donning of PPE, depending on their role, but if we are talking about the quarantine staff, as we discussed earlier, are likely to have contact with people in quarantine, then they should be getting into the appropriate PPE and then, as they are leaving their shift, they should be taking their PPE off in an appropriate sequence and manner and disposing of it in an appropriate manner in terms of infectious waste or potentially infectious waste.

Q. Relevantly, would there be any distinction between the hospital infectious diseases ward and the quarantine hotel situation?

A. No. When we talk about an infectious disease ward, obviously there is a different context because we have a --- but if you mean a COVID ward, an area of COVID or SCOVID as we discussed earlier, no, it should be similar, as I described, the ability to meet the standards of quarantine, regardless of whether it is a hotel or not.

Q. Yes. Let me ask you this as an idea: in order to establish a red hotel, that is, a hotel in which positive COVID cases are quarantined, would it be a more appropriate idea to design the quarantine in such a way that a quarantine bubble effectively is created, so that those who are servicing the quarantine people themselves do not go in and out in between their shifts?

A. I'm not quite sure what you mean by a "bubble". Do you mean that the staff who are caring for those in quarantine should sort of be in a restricted area so they don't go out into the community?

Q. Yes.

A. I don't believe that's necessary. That's certainly not what happens at hospitals. Medical and nursing staff go home to their families and they are members of the community. So to sustain a bubble like that is not necessary and has not been undertaken in other quarantine settings. In essence, if I understand your question correctly, the staff in quarantine are almost like those they are looking after and that's not been necessary and it's the whole point of PPE and the other measures that, as best one can, you are keeping those staff safe so they can go about their normal lives. Of course, they are members of the community so out in the community they may be --- depending on the situation --- they are in the standard community, they have to be able to --- they are members of the community.

Q. There is another set of questions that are designed around the question of airflow, and some specific ones that I will now put to you.

What do you say is best practice in relation to airflow in an hospital such as an infectious diseases ward?

A. Well, this depends on the infection. So there are some infections where we know that there is high risk of airborne transmission --- tuberculosis, for instance, or measles. In those situations they are often in what we call a negative pressure room, that is, that the air that is drawn into the room and then ventilated out into the atmosphere without allowing it to be recirculated, whereas often the air handling in the other --- in the rest of the ward is what we call positive pressure, that is, air is coming into the ward from outside and it then is partially recirculated.

For coronavirus, unless the patient is extremely symptomatic, it has not been found necessary to put them into negative pressure isolation, so they would be in a routine --- when you talk about an infectious disease ward which includes everything from golden staph, bacterial infections through to fungal infections and other things, it's a very general question, but to get to the point, I suppose, that the key thing usually is a single room with its own ensuite, so there is physical isolation and the air handling within that ward is dependent upon the likelihood of airborne transmission. And as I mentioned, only in very defined circumstances do we consider it necessary to put someone into negative pressure ventilation single rooms.

Q. Do you accept it is possible that the aerosol particles of viruses can, so to speak, hang in the air if the airflow is low?

A. Yes. A good example would be, you know, within the hospital environment, such as a tearoom where there are often internal rooms and they are small and the ventilation is not --- it's an equation of how many people are in the room versus the airflow of that room. So they can be at risk and of course if one is taking your mask off, let's say in the case of tearoom, well then the key precaution, namely wearing a mask, as well as physical distancing is lost, so that adds to the issue. So in that sort of situation it's a combination obviously made worse by poor airflow but it's a combination of difficulty with physical distancing and the fact that if one of the staff is in the room there with you hasn't got their mask on, for obvious reasons, if they are eating or drinking, then that adds to the risk.

Q. In the hotel quarantine environment, what practices could be employed to increase airflow, on your understanding?

A. I'm sorry, it's too general. Like, it would depend on the hotel and the level of percentage of recirculated air and what the room is. I think they are just basic principles, that adequate ventilation is important, but I don't think I can be more specific. It's a specific --- you need a specific example, and it's about, I guess, to go back to the first point, it's about having adequate spatial --- adequate space, both whether it's for people in quarantine as well as the staff who are working there.

Q. Would the simple technique of opening a window improve the situation?

A. Not necessarily. In fact, in some cases opening a window, if you have got --- air-conditioning systems are set up to maintain adequate airflow based on --- it's a complex issue actually, so opening a window can completely mess up the airflow. As an example, if you were to open a window in a positive pressure environment, then all the air would just blow out of the room out the window. So opening a window sounds simple, but actually, if the air handling system of a facility is designed to have the windows closed, then the windows should be closed. Otherwise the physics and the airflow is distorted by opening the window.

Q. Is it fair to say, as a generality, that in terms of good infection control practice that locations in which there is low airflow are undesirable?

A. Well, if people are there in that room, obviously some rooms, where it's storage cupboards or something where no one goes in, that's a different matter, but, yes. Obviously if there is poor or low airflow, inadequate airflow for the number of people in the room, then there is a lot of re-breathing of others' air rather than inadequate ventilation, so the chance of exposure, the issue of 1m or 1.5m physical distance becomes lessened. That's been --- in my statement, say, with choir practice or fitness gyms and things like that, that's been the case for the number of people there and the air that they are blowing out, that there was inadequate ventilation and hence there was a risk of inhalation of coronavirus.

Q. I wanted to ask you some questions now around the topic of "a green zone" in a hotel, that is to say an area --- or presume, if you will, that an area has been designated in a COVID positive hotel as a green zone for the purposes of staff taking breaks, preparing for their meals and consuming meals, et cetera, and that the staff using that area include a variety of workers, nursing staff, hotel staff, security personnel, et cetera. The question then is: would that be an appropriate area to establish in an infectious diseases ward of a hospital or would it pose a risk for infection control?

A. I think the term "green zone" is misleading. Really, these areas are not clear. If we are talking about a red hotel, maybe the analogy is they are crimson. That is, they are in that area and staff who are working --- let's say it's a tearoom or whatever --- that they're not an area you can consider entirely safe. You have still got to take some precautions. Indeed, if I use the Austin's example, great attention has been paid to how many people share tea rooms, whether there's spatial distancing, people not staying beyond the time they need to eat and drink when their masks are off, that those zones are considered a risk, a transmission risk area. So I think I know what you are getting at with a green zone, but sort of a green zone implies complete safety and these areas are not --- can never be completely safe, if one of the staff members --- I mean, you have to assume --- for it to be green, you would have to assume with absolute certainty that all the staff members who are using that area had no chance of being infected, because otherwise, as soon as one of them has potentially acquired an infection, it's no longer green, it's basically like a ward area, but with no PPE being used.

Sorry, does that answer the question?

Q. I'm taking you to say you would need extremely rigorous infection control procedures to accept that a green zone is really a green zone when people are exiting and entering that zone; it's only a notional green zone unless you have extremely rigorous control over it.

A. Correct.

Q. Would you go so far as to say, for example that in areas where staff congregate for food and other reasons, that there be physical screening of them because they are going to take masks off?

A. I think the main risk is --- well, if they are spatially separating, that is, 1.5m apart and there are rules about how many individuals per square metre are using that mathematics of social distancing, then a physical screen is really not going to help because you should be already adequately distanced for droplet spread without the need for a physical barrier. The issue is more about how many people are in the room and the re-breathing of other peoples' air at a time when their mask is off. So I don't believe a physical screen would help in that sense because that's not going to alter the air dynamic. In fact it could harm it.

Q. Does it follow, for example, that if a hotel cleaner is coming into an area having cleaned down lifts, et cetera, that it's hardly an effective green zone?

A. Sorry, if the hotel cleaner was?

Q. Has say, for example, been disinfecting lifts and hard surfaces, coming into a green zone would immediately ruin the integrity of the green zone?

A. You mean using the same cleaning material as what was used --

Q. And bringing in cleaning materials, cloths, et cetera?

A. Well, that's a complete breach. If they were unused but they have been used in an area that's potentially infectious and then used the same cleaning cloth or whatever, that would be inappropriate.

Q. You may have already answered the question but as I understand it, if people are in a confined space with poor ventilation, that is one physical environment in which there may well be the prospect of airborne transmission?

A. Yes. So it is sort of close airborne transmission, if you like, as opposed to ventilated air-conditioning systems. But certainly that is --- speaking again for the Austin, that is where, on the small number of occasions where we have had staff-to-staff transmission, it has usually been in, and we have tracked back to identify where the acquisitions could have occurred, it's been in areas like the tearoom, that we had the greatest suspicion of acquisition. It's a well-known risk and of course it's about the physical space and it's about perhaps people --- you know, it's considered an area for relaxation, in terms of eating or drinking, and people let their guard down and they don't follow the rules as well as they would normally do.

Q. I have a number of questions, then, in relation to best practice for quarantine purposes in relation to transmission through surface contact. If your expertise doesn't let you say, you can tell me. But what do you understand would be best practice in relation to the use and cleaning of lifts, for example, where the idea is to prevent the transmission of a disease?

A. Firstly, you would expect that anyone who --- any of the people staying in quarantine would have a mask on.

CHAIR: Sorry to interrupt you, Professor Grayson. I have just been given an indication, Mr Neal, that apparently the live streaming link has dropped out. I do apologise, Professor Grayson, this is the unfortunate imponderable of technology, and I'm sure you understand the importance of maintaining a public live streaming. I am just being asked to take a short break whilst the technology people do the work that they are engaged to do and get us back on to live streaming. I can see you nodding, Mr Moses, so I understand that you can hear me.

MR MOSES: Yes, Commissioner.

CHAIR: You understand that has happened. I'm sorry, we will just take a short break and hopefully this won't take too long to fix up. I will again leave the room.

ADJOURNED **[2.24 PM]**

RESUMED **[2.35 PM]**

CHAIR: I understand we are ready to proceed again, Mr Neal.

MR NEAL: Thank you, Madam Chair.

Q. Professor, just before our interruption, we were talking about cleaning surfaces, in particular the question was around best practice in the use and cleaning of lifts, where preventing the transmission of an infectious disease is the critical outcome.

A. Yes. So the cleaning of lifts, like any space, the risk areas would be those where --- well, assuming that the people who are travelling in the lifts were wearing masks and not coughing and spreading --- potentially contaminating the walls of the lifts with droplet material, if they are wearing masks, then the main risks would be those areas where they had been touching elements of the lifts with their hands which could be contaminated, so that would be rails and I guess the walls of the lifts potentially and the buttons in the lift. If you weren't wearing a mask, obviously the air --- it's a small space, most lifts, and the area that could be contaminated if someone was symptomatic could be wider.

Q. Are there particular, just generalising this from lifts, to other high touch surfaces? Are there infection control standards that need to be adhered to? Are there recognised standards of cleaning, for example?

A. Yes. Usually, the standard, if we are talking about an analogous situation, both in the coronavirus ward, say, here at the Austin, or if we are talking about superbugs, the standard is to use bleach to clean the area, a combination of detergent and then bleach, usually 1,000 parts per million bleach kills everything. There are some components that can't be cleaned with bleach and they are cleaned with just detergent. But obviously in the example you are giving with the lift, all of those areas could be cleaned with 1,000 parts and indeed at the Austin, everything is cleaned with 1,000 parts per million of bleach, whether it is a COVID ward or not.

Q. In relation to the use of a lift, is it best practice to allow people who are infectious and non-infectious to use the same lifts, or desirably otherwise?

A. Well, they shouldn't use it simultaneously. But the use of --- I mean, ideally you would have those who are in quarantine using one set of lifts and those who are not in quarantine, as an example, using a separate set of lifts. But I guess practicality often dictates that the lifts are limited. So if we use the example of one returned traveller uses a lift on one occasion, then another uses it on another, so long as they didn't touch anything inside the lifts and were both wearing masks, it would be adequate and usually there would be a regular system of cleaning of the lifts, just for --- someone obviously has to touch the buttons to dictate where the lift is going; it shouldn't be the quarantined person, though.

Q. What do you say about allowing guests in this hotel environment who are either confirmed or suspected cases of COVID to travel in lifts and into the common areas of hotels just wearing masks?

A. So long as --- ideally they should hand-hygiene before leaving --- at the point of leaving their room. But a mask would be a minimum standard, so long as they didn't touch anything. If they were likely to touch something, that's a different matter. But that would be akin to the hospital situation, if I could suggest, for a patient with suspected COVID or COVID going down for an investigatory CAT scan or a chest x-ray, they would need to be transported to those areas and they are closely supervised and ensured that they don't come into contact with any shared facilities, such as lifts, and they are wearing a mask.

Q. In an infectious diseases ward, is there a particular standard for airflow?

A. So it comes back to what we were discussing before, whether or not the area --- whether it requires negative pressure, ventilation or routine positive pressure ventilation. For instance, in current wards used by our COVID and SCOVID wards, the majority of the ward is positive pressure ventilation with a limited number of negative pressure ventilation rooms, specifically designed for increased --- improved airflow, if the patient is particularly symptomatic.

Q. That's a standard of airflow which is, say, different to what you expect a hotel --- a lobby area of a hotel?

A. I can't answer that because it would depend on the circumstances of a hotel. Obviously, hospitals vary also. There are newer standards for newer hospitals and so usually they are designed in a better way than what was the case --- many of the hospitals have older facilities where things have changed over time. So it would depend on the specifics of the hotel that you are describing.

Q. Taking it into the hospital environment again, would somebody suffering from something highly infectious, COVID, measles or whatever, actually be allowed to walk into common areas of the hospital to go to a vending machine or do things of that nature?

A. Well, no. Measles, as I mentioned earlier, because it is highly airborne

transmitted, so that would be negative pressure --- or TB, they would be in negative pressure isolation and would not be allowed to leave except under very regulated circumstances with a staff member with them and with mask precautions and so forth. In the case of a COVID ward, absolutely not. All patients have to be supervised by a trained staff member and going to vending machines is not part of that.

Q. In the hospital environment, in terms of infection control, do cleaners have particular standards of training?

A. Yes.

Q. Involving what?

A. The cleaners --- in the case of the Austin, all the cleaners are trained in the use of bleach, 1,000 parts per million cleaning with bleach, as well as other materials, but bleach cleaning is the standard throughout the hospital. It is not necessarily the case in every hospital but certainly here, and absolutely in an infectious disease ward, including the COVID and SCOVID wards, and to do that cleaners require additional training to the basic cleaning course that they will have done to become a cleaner in the hospital, because bleach has some health and safety issues that are easily dealt with if you follow the correct protocol but they need to learn that and obviously, also, as you alluded to previously, to learn not to reuse certain cleaning items if there's been a particular --- you are dealing with a particularly high risk case, then those cleaning items aren't used from one room to another, they are segregated.

Q. Would there be any sensible reason for distinguishing between the standards required for cleaners in your hospital environment and, for example, what is called the red hotel, where positive COVID cases are quarantined?

A. No, they should be the same. That includes certain --- as an example, hospitals don't have --- the ideal hospital does not have carpet, it has cleanable floor surfaces and so forth.

Q. For that infection control reason?

A. Absolutely.

MR NEAL: Madam Chair, they are the questions I have for Professor Grayson.

CHAIR: Yes. Professor Grayson, I understand that Mr Moses has some questions for you before you are going to be excused, so I will ask you just to bear with us. Mr Moses, I will ask you to unmute your microphone and invite you to put your matters to Professor Grayson. I just confirm that Mr Moses previously made contact through you, Mr Neal, and sought leave to raise some matters with Professor Grayson, and that leave has been granted, Mr Moses, so I will allow you to proceed.

CROSS-EXAMINATION BY MR MOSES

MR MOSES: Professor Grayson, I act for Unified Security Group, which was one of the security providers at some of the hotels subject to the quarantine program.

Professor, you have given evidence today about the nature of COVID-19 and its potential methods of transmission. What you have told the Commission, as I understand it, is that the modes of transmission include primarily droplet and then fomite and possibly aerosols; correct?

A. Correct.

Q. COVID, of course, can be caught through eyes, which is why health workers wear eye protection in the infectious diseases wards; correct?

A. That is correct.

Q. Is that correct, Professor?

A. Yes, correct.

Q. Thank you. Professor, as you know, part of this Inquiry's purpose is, of course, to ascertain what is fact and what is fiction in relation to what was occurring within the Hotel Quarantine Program as there's been quite a lot of rumour and innuendo in relation to alleged inappropriate contact between guests and security guards. By "inappropriate", to be blunt, what I'm referring to is rumour and innuendo about alleged sexual activity between security guards and guests. So I just want to ask you some questions about the scenarios under which work was being undertaken by security guards.

The first proposition is this: given the nature of COVID-19 and the potential methods of transmission that you have given some very helpful evidence about today, would you agree that there may be many ways in which staff, including security staff, could contract the disease through interactions with quarantined guests that were expected or required interactions, rather than being as a result of some type of inappropriate contact between staff members and guests?

A. Well, yes. But it's sort of a leading question, if I could --- I think that --

Q. Cross-examination, Professor, usually is leading. But if you don't accept the proposition, you should tell me and I'll take you through a number of scenarios shortly.

A. Of course. If quarantine staff are taking the appropriate precautions, PPE

precautions and the other things that have been discussed about the physical space, then the risk of acquisition should be markedly reduced, without any consideration of the rumour and innuendo items that you mentioned.

Q. I want to go through a number of scenarios concerning the work undertaken by security guards in relation to their interaction with guests as part of their duties and ask you some questions about it.

First of all, security guards assisting in the movement of quarantined guests disembarking from SkyBus buses, that is, buses from the airport and entering hotels, do you agree that it could be possible for staff members such as security personnel to contract COVID-19 through such an interaction?

A. Well, if they were wearing appropriate PPE at the time to protect themselves, then obviously there is always --- PPE is not 100 per cent but it's, at least in high risk areas in hospitals, it has proven to be extremely protective. So if the staff member was wearing appropriate PPE when assisting quarantined people from the SkyBus, then their risk should be incredibly restricted.

Q. By that, Professor, you mean wearing a mask?

A. Absolutely. Mask, and I mean, they are having an interaction with a potentially infectious person. The fact that they're on a SkyBus or not is not relevant to this, they are about to enter quarantine because they are considered at risk of being infectious, so they should have --- as I said in my statement, they should have a gown and mask, eye protection and ideally, if they are going to handle objects that belong to the individuals, that they wear gloves because those objects may be contaminated and cause fomite transmission.

Q. Professor, you are aware, aren't you, now of course that the Hotel Rydges was where confirmed COVID cases were being sent; correct?

A. I wasn't aware of that but I'm happy to accept that that's a fact, yes.

Q. I will come to that in a moment. What about this scenario: security guards being required to assist with handling quarantined guests' baggage? You accept, don't you, that it is possible that, in that scenario security staff, through such interactions with COVID-19 positive guests, could contract COVID-19 through that interaction; correct?

A. If they were wearing the appropriate PPE, the risk would be extremely small. So I guess the question, to come back, is were they wearing the appropriate PPE? If not, then their risk would be greater than if they were.

Q. Okay. Thank you.

A. Is that what you were meaning, with or without PPE?

Q. Thank you. Yes. I'll come back to that in a moment. I'm going to show you a document.

What about this proposition: interactions with quarantined guests by virtue of being required to enter lifts with infected guests or fresh air walks and movements in lifts generally, where there may have been COVID positive guests, is it possible in that scenario for security staff to contract COVID-19?

A. Yes. Less so if they were wearing appropriate PPE.

Q. But as you have, I think, discussed with Senior Counsel Assisting in relation to lifts and the use of lifts within the infectious diseases ward, it is important, isn't it, that there be rigorous cleaning undertaken in respect of such lifts where patients are entering who are both positive and negative?

A. There's a standard cleaning. I mean, the analogy is not quite correct, in that for patients who are moved around the hospital, they are moved around in a wheelchair and so --- and they are not able to touch any element of the lift.

Q. Correct.

A. And at the point even when they are admitted to the hospital, they are placed in a wheelchair and then taken to the relevant ward. So there is --- but there is a standard cleaning protocol using the 1,000 parts per million bleach of the lifts, as a routine for the entire hospital, because they are used for other purposes also.

Q. But that is in circumstances where there is controlled movement of patients in an infectious diseases ward by hospital staff, where they are transporting them from area to area; correct?

A. Yes.

Q. Thank you. What about, is it possible for security staff to contract COVID-19 through interactions with COVID-19 positive guests, in relation to interactions on the floors of hotel quarantine guest rooms, that is, in the hallways and corridors?

A. If the --- it's possible. But of course if they are wearing appropriate PPE, the purpose of that is to prevent that acquisition. If --- the key issue I think you are getting at, is that in those corridors and so forth, there's always the risk of an unexpected interaction or it may even be expected, and in both those situations that is the whole point of wearing PPE, appropriate PPE in that area, to cover off both the expected and unexpected interactions with potentially infectious guests.

Q. Such as when delivering Uber Eats and supermarket deliveries and the door is open to a hotel room, that level of interaction, that may make it possible for a COVID-19 positive guest to infect a security staff member; correct?

A. Yes, but that's the whole point of them --- why they should be wearing PPE at that time because it is an interaction that poses a risk. It's analogous to a nurse or a staff member taking a meal to a patient in a single room in the hospital.

Q. I just want to go back, then, based on that scenario, to some answers you gave Counsel Assisting. You understand in your role at the Austin that airflow change is incredibly important to prevent aerosol transmission. You understand that as part of your professional duties; correct?

A. Yes.

Q. And you well understand, don't you, Professor, that the airflow change on a COVID ward in a hospital of course is not the airflow that exists in a hotel? You know that, don't you, as a matter of fact?

A. I can't answer that. It would depend --- firstly, I should clarify that the COVID wards at the Austin have the same --- I mean, particularly with the surge in numbers, wards that would be otherwise routine wards for managing other things have become COVID wards and the air handling has not changed because of that, because --- you know, they are the same as before. But I can't answer your question because I don't know the air handling of each hotel and the floor within each hotel. I'm sorry, I can't answer that.

Q. That's okay, Professor. But you agree, don't you, that if there isn't a filter that is used in hospitals to remove virus out of the air to protect staff outside the ward room, if there isn't such a filter in hotels, that would have the probable effect where the air outside a guest's room could potentially contaminate individuals in the hallway in a hotel. You accept that proposition, don't you?

A. I think your question is not sufficiently exact for me to accept it. I think, if you are getting at HEPA filtration of air, there are certain high grade filters that can adequately filter the air to prevent transmission. Indeed, we use them more for air cleanliness into rooms that have patients with incredibly low immune systems, so you know, leukaemia wards and things like that. In terms of the cleaning of air, exhaled air from, let's say, a room, then if it's in a negative pressure room then usually that's just ventilated straight out into the dilution aspect of the open air and not --- it's not HEPA filtered at that time. So HEPA filtration is a very specialised area and special air handling is required to have HEPA filtration, but mostly the HEPA filtration in a hospital setting is actually about ensuring clean air coming into a room rather than it going out, being ventilated.

Q. Let me just come at it this way, then, just to be clear. You accept that air control is an important factor for airborne transmission; correct?

A. Correct.

Q. You accept this proposition, don't you, that in relation to hotels, sitting here today, you have no idea of what the air control or airflow was in any of the hotels being used for hotel quarantine; correct?

A. Correct.

Q. And, hence, you are not in a position to provide an opinion in relation to whether the airflow within those hotels was of a sufficient grade in order to minimise airborne transmission of COVID; correct?

A. So I can make the comment --

Q. Professor, do you accept that proposition?

A. Well, with some qualifications. So if I could list the qualifications. So the questions that were asked previously were about specific rooms with --- you know, so-called green zones and so forth where there was very limited air handling. But if you are talking about the general --- given that we --- the widespread dissemination, that is, airborne transmission such as would occur, let's say, with measles, does not appear to be the case with coronavirus, based on epidemiological data. That is, it's more related to beyond --- within a region that is beyond 1.5m with poor air handling, then I can comment on that. But obviously I don't know the air handling systems of every hotel that was used in the quarantine, so I can't say for certainty in each case.

Q. Okay. Thank you. Do you accept this proposition --- and tell me if you don't --- do you think that the same lift should be used by travellers who have tested positive for COVID, and negative staff?

A. Well, it depends on the --- so, in the hospital, to give you an analogy, those lifts, the same lifts are used in the hospital setting but the positive quarantine people are wearing masks and therefore minimising the transmission, and there's an appropriate cleaning regimen. So, therefore, the use of those lift, given if one accepts those two premises, that the use of those lifts by uninfected staff is okay.

Q. I want to come back, then, if I can, to the lift proposition. You told Senior Counsel Assisting in respect of the level of cleaning that would be required for such lifts that occur in hospitals. Do you recall giving some evidence about that?

A. Yes.

Q. Again, sitting here today, you don't know what level of cleaning was being undertaken within the hotels within the Hotel Quarantine Program; correct?

A. Correct.

Q. Thank you. I just want to cover off one more thing on the lifts, then I will show

you a document. You gave some evidence today in answer to a question by Senior Counsel Assisting concerning the issue of SARS in Hong Kong in 2003. Are you aware that in respect of what occurred in Hong Kong concerning SARS in 2003, that airflow in corridors and rooms and lifts meant that the droplet nuclei was likely to cause transmission of SARS? Were you aware of that?

A. Not to the level of detail that you mention, no. I was aware that ventilation systems and indeed sewerage systems were crucial to the control of it and an awareness of that. But you are asking me about the specifics of air handling in facilities in Hong Kong in 2003, I'm not aware of the exact specifics.

Q. In relation to, if I can just ask you a question about a hotel that had exclusively COVID-19 positive guests, a hotel that exclusively had those type of guests being sent there, and by way of example I'm referring to the Rydges Hotel, would you expect that the way in which those guests are dealt with is exactly the same way that you would expect that they be dealt within the ward that you have custody and control of at Austin, as an infectious diseases ward; that is, you would expect that they be treated at the same level of conduct and concern that patients would be treated in your hospital? Do you agree with that?

A. Yes.

Q. Thank you. Again, you don't know, sitting here today, whether there was any consideration of that issue concerning the Rydges Hotel; correct?

A. Correct.

MR MOSES: Can I ask that the witness be shown the document USG.0001.0001.3788? If that could be placed on the screen for the witness.

Professor, what's being shown to you on the screen is a document entitled "PPE Advice for Hotel Security Staff and AO's in Contact with Quarantined Individuals."

It is version 2.2 dated 8 June 2020 issued by the Department of Health and Human Services. Can I just ask that you read the first entry of the document and also the second entry, so "Hotel Lobby":

> *When accompanying clients for fresh air or exercise breaks from room to outside, maintain a distance of at least 1.5 metres. No PPE.*

Do you see that?

A. Yes.

Q. You don't agree that that's appropriate, do you?

A. I'm sorry, there is a double negative. What I would say is that that

recommendation is inappropriate.

Q. In relation to the other entry, on "Hotel Lobby":

When new guests are arriving for the commencement of their quarantine.

You will see there alongside "Security staff", "No PPE". Do you see that?

A. Yes.

Q. You would regard that to be inappropriate advice?

A. Yes, I do.

Q. Again, "Hotel Quarantine Floor, security staff, no PPE." Would you also regard that to be inappropriate?

A. I do.

Q. Again, "Doorway indirect contact by security", do you regard that advice from the Department to security staff, "No PPE", to be also inappropriate?

A. I would need clarification, what does "Doorway indirect contact" mean?

Q. As a scenario, and you can please make this as an assumption, purely as an assumption, where there is, in effect, the door opened and items left at the end of the --- or at the bottom of the doorway for guests to take, in that scenario.

A. So the doorway of a room?

Q. Yes. Guests are in there, window shut, the room door is opened and what they are doing is placing an item on the floor like Uber Eats?

A. No, I disagree, it is inappropriate, those recommendations. I guess there is one thing to add and this is about the 1.5m because, as I mentioned earlier, one of the things --- it's the not just about the 1.5m, the PPE is needed anyway, but it is also because there is a level of unpredictability of that 1.5m suddenly becoming less in those scenarios, so that's an additional point.

Q. Thank you. Professor, I have no further questions.

MR MOSES: Commissioner, thank you for your patience in allowing those questions to be asked. Thank you.

CHAIR: Thanks, Mr Moses. What is the status of that document, Mr Neal, that Mr Moses has just been referring to? It will come via another witness later during the Inquiry?

MR NEAL: I think the answer is very probably. It's a very familiar document so I imagine it will be.

CHAIR: All right. If there is no objection, it would be helpful, I think, to just for identification purposes at this stage, place it on to the Exhibit list when it comes to making sense of the transcript. No objection from you, I take, Mr Moses?

MR MOSES: There is no objection.

CHAIR: Thank you. I will mark in the document that is headed "Operation Soteria" and has the date approved 8 June 2020, version 2.2, as Exhibit 4.

EXHIBIT #004 - DOCUMENT HEADED "OPERATION SOTERIA", DATE APPROVED 8 JUNE 2020, VERSION 2.2

CHAIR: Mr Neal, nothing further of Professor Grayson?

MR NEAL: Nothing arising, no. Thank you.

CHAIR: Can I clarify one matter with you, Professor Grayson, before you are excused. It goes back to an issue in your statement, and Professor Grayson's statement doesn't need to be brought up, but it touches upon the section of your statement that refers to the transmission of the virus, what's been referred to as the R_0 procedure. You gave evidence, I think it's both in your statement and you gave oral evidence, that that transmission process is affected both by the nature of the virus and also the behaviour of the infected person. I just wanted you to focus on the second part of that, the behaviour of the infected person. If you could just clarify for me what you mean when you say that, about the behaviour of the infected person that impacts on the transmission.

A. Just two things perhaps, if I could. Firstly, the R_0 is a measure of community transmission, not an individual, necessarily. It's not like everyone has --- well, you could calculate everyone as R_0 and work them out as a community. But the R_0 concept is used to measure overall community transmission. Obviously, as we discussed, some individuals could be super-spreaders and others less.

Yes, of course, behaviour in fact is probably, apart from the nature of the infecting agent, in this case coronavirus, the behaviour of individuals will influence the likelihood that they can infect others and therefore alter the R_0. We have seen that, it's why the current lockdown measures and restrictions of people's movements and interactions is all about behaviour change, it's not changing the virus, it's simply changing the amount of interaction and behaviour change of individuals and therefore restricting the likelihood that if they are infected with the virus, that they can transmit it to others. So public health measures are a key intervention to reduce

the R_0 in a community. Does that answer?

CHAIR: Yes, thank you. Anything arising out of that, Mr Neal?

MR NEAL: No.

CHAIR: Thank you, Professor Grayson. Thank you for your attendance. I'm sorry you had to bear with us for those interruptions. I will excuse you now and let you leave the virtual hearing room.

A. Thank you very much.

THE WITNESS WITHDREW

MR NEAL: It's being indicated to me that we might need a five-minute break for the changeover at the moment.

CHAIR: Our next witness is Professor Howden, Mr Neal?

MR NEAL: That's correct.

CHAIR: I understand Professor Howden is on standby.

MR NEAL: Yes, that's my understanding too.

CHAIR: We will take a short break now to have Professor Howden brought to readiness.

It looks like he might have arrived. Can you hear me, Professor Howden?

PROFESSOR HOWDEN: Yes, I can, thank you, yes.

CHAIR: Are you ready to proceed and happy to proceed now, Professor Howden?

PROFESSOR HOWDEN: Yes, certainly, thank you.

CHAIR: And you too, Mr Neal?

MR NEAL: Yes, your Honour.

CHAIR: Professor Howden, I understand that you are taking the affirmation for the purposes of giving your evidence?

PROFESSOR HOWDEN: That's correct.

CHAIR: I will have my associate administer the affirmation and then hand you back to Mr Neal.

PROFESSOR BENJAMIN PETER HOWDEN, AFFIRMED

EXAMINATION BY MR NEAL QC

MR NEAL: Is your full name Benjamin Peter Howden?

A. Yes, it is.

Q. Have you provided to the Inquiry a witness statement dated 4 August of this year?

A. Yes, that's correct.

Q. Do you have a copy of your witness statement to hand?

A. Yes, I do.

Q. Are you content that it is true and correct to the best of your knowledge and belief?

A. Yes, I am.

Q. You have also provided a curriculum vitae with that witness statement?

A. Yes.

MR NEAL: I will tender both of those documents, if the Board pleases.

CHAIR: Exhibit 5 will be the statement of Professor Howden. Exhibit 6 will be the CV of Professor Howden.

EXHIBIT #005 - STATEMENT OF PROFESSOR BENJAMIN PETER HOWDEN

EXHIBIT #006 - CURRICULUM VITAE OF PROFESSOR BENJAMIN PETER HOWDEN

MR NEAL: Professor, you have provided your witness statement in the form of answers to the questions that were posed to you. It is a lengthy statement, very

helpful and very comprehensive. What I will endeavour to do with you is to take you through some of the salient points and not necessarily take you through formalities, apart from your qualifications and positions, which I will start with now.

You are the Director of the Microbiological Diagnostic Unit, Public Health Laboratory at the University of Melbourne?

A. That is correct, yes.

Q. You have been in that position since 2014?

A. Yes.

Q. Apart from your qualifying degrees, you are a fellow of the Royal Australian College of Physicians (Infectious Diseases)?

A. Yes.

Q. A Fellow of the Royal College of Pathologists of Australasia (Microbiology)?

A. Yes.

Q. You were awarded your PhD in molecular biology from Monash University in 2009?

A. Yes, that's correct.

Q. Prior to your present position, you were the head of microbiology and an infectious diseases physician at Austin Health?

A. That's correct.

Q. Could I start by asking you to give a summary, perhaps, of your expertise in the area of genomic sequencing?

A. Yes. I started in the area of genomic sequencing of human pathogens through my PhD approximately 15 years ago and I have been undertaking research in that area since that time. I have also, since I started as director of the MDU Public Health Laboratory brought that science of pathogen genomics and genome sequencing into public health microbiology in Victoria. We are one of the leading laboratories in the country and around the world in using pathogen genomics technology for public health and we have brought it into the context of day-to-day public health practice in Victoria in partnership with the Department of Health and Human Services.

Q. For present purposes, a pathogen is a microorganism that can cause a disease?

A. That's correct, yes.

Q. And a virus is one such pathogen?

A. A virus is one example, yes.

Q. What is your current role in the genomic sequencing program in Victoria?

A. I'm director of the MDU Public Health Laboratory, as I've said, and this is the primary laboratory for undertaking public health pathogen genomics in Victoria through a well established collaboration in partnership with the Department of Health and Human Services, and our remit is to bring pathogen genomics, that is, genomic sequencing of pathogens of importance to human health and public health into day-to-day public health practice in Victoria as well as nationally in Australia.

Q. Is one of the aims of the unit to sequence samples from all SARS-COVID-2 cases in Victoria?

A. Yes. Once SARS-COVID-2 emerged as a new pathogen earlier this year in Australia, we undertook to deploy our technologies to sequence the virus effectively and with a plan to sequence all cases that were available to be sequenced in Victoria.

Q. In your statement you draw a distinction between comprehensive and --- comprehensive sequencing and subsampling. Could you explain what is meant by that?

A. Yes. For each case, not every single case of a particular disease necessarily undergoes genome sequencing for a number of reasons, not least because it is a complex technology, it is quite intense in time and resource-intensive to undertake, but also costly. Therefore we have to prioritise how we use this quite important public health resource for public health purposes. When I'm talking about comprehensive sequencing, I mean to the point where we can get the best picture possible of what the data is able to tell us, the most comprehensive nature of that information. In an ideal world we should sequence every available sample of a particular pathogen if we are trying to understand the emergence or spread or behaviour of that pathogen. Therefore, with the emergence of this new, obviously incredibly important disease, we undertook to examine all possible samples.

Q. As opposed to another form of disease or virus where it might be sufficient or pragmatic to sample only part of the available sampling?

A. That's correct. It depends on the question that's being asked. If you want to understand a particular question of public health importance you may only need to sample a proportion of cases.

Q. Yes. If I can ask you to turn to what seems to be a simple question but may not have a simple answer, which is what do we mean when we talk about genomic sequencing?

A. Yes. What we mean in terms of this particular pathogen, when we talk about genomic sequencing, we are talking about trying to recover the whole genetic signature of the virus. This virus has a genome size of approximately 30,000 bases, that is like 30,000 letters in a row and when we undertake genomic sequencing, we aim to recover the majority of those letters in their correct sequence, is that gives essentially the genetic code of that virus.

Q. Do I understand correctly when you are comparing one sample from another and you go through the process that you have just described, although there will be high degrees of similarity in the sequencing, there may also be differences?

A. That's correct. We know that pathogens, including viruses, develop mutations over time and those mutations could occur anywhere in those 30,000 letters I have described. As they accumulate over time, they essentially act like a passport stamp on that viral sample so that we can start to trace back where that virus may have been previously and use that information for inferring important public health information.

Q. Does it work something like this: I think you refer to a 30,000 --- is it 30,000 steps effectively that you are measuring. Does it work something like this: that in two different samples, if you have --- of the 30,000, you have a particular change or difference at a particular point in the sequence or several changes in a point in the sequence that are exactly the same as another sample, then you are prepared to say this is the same, because of the mutations?

A. That's correct. That's how the inferences are made. We use sophisticated statistical and bioinformatic programs to make those inferences because we are comparing genomes from multiple samples across 30,000 individual sites and so there's obviously a very complex statistical approach to doing that. But if you had two samples that have the identical sequence, they would cluster together completely during the analysis and we would then be able to say that, genomically, these two samples are identical or incredibly highly related, they cluster together, we can report that back to the epidemiologists who can use that information to understand why these two cases are clustering together and that could be useful public health information.

Q. Can you say why mutations will occur in what might be thought to be the same virus?

A. Yes. All pathogens do acquire mutations over time, it's a natural part of the evolutionary process of pathogens, and whether we are talking about viruses, bacteria or other types of pathogens, they all acquire mutations over time at different rates. Some of these mutations do not lead to any difference in the behaviour, and most of them don't, but some of them are acquired because of selective pressures. If you go to another example like a bacteria and you expose it to an antibody, it will develop a mutation that helps it survive in case of an antibiotic. In terms of a virus, we do know they develop mutations over time, and most of these do not lead to changes in

behaviour but they do lead to signatures that allow us to compare the sequences between the different strains.

Q. Is it the case, then, that mutations help identify differences between viral genomes and make it possible to compare the genomes of multiple different sorts to see how similar or how different they are?

A. Yes. We have now well-established that we can effectively and accurately compare the genomes from multiple samples and use what we call clustering, so genomic clustering to identify which of the genome samples are highly related or identical to each other and that can then be used to infer epidemiological links between those cases.

Q. Is it the case that two genomes can be identical?

A. Yes, it is possible. I might give an example. If you had a household where two members of the household both had COVID-19 and one had caught it from the other, they've caught the virus at almost the same point in time, there's been not much opportunity for that virus to develop another mutation or two, although it could still do that in that situation but most likely if we sequenced the genome of those two samples from that household they would be essentially be identical.

Q. Is the closeness of the genomic sampling something that enables you to infer a transmission network?

A. With this virus, what we can do is cluster genomes together and what that does is allow us to say that these cases are all related to each other at a genomic level but we cannot infer direction of transmission because we need to link the genomic data with epidemiological data to draw those inferences. For example, if we had cases that were clustered together and lived in the same household, you could rightfully infer that they have likely spread it to each other. But it is also possible that two genome sequences might cluster together but those two people have never been in contact with each other, and yet there has been a case in between those two that's not necessarily identified in the genomic sampling.

Q. Yes. In your statement you refer to the concept of both epidemiological clustering and genomic clustering. Could you just explain to us the difference between those ideas?

A. Our laboratory works in the area of genomics so we use genome sequencing and then mapping of mutations between different samples to cluster together samples that have almost identical or very similar genome sequences and that is called genomic clustering, and we can use that to suggest that samples and the cases that these came from likely have a common source of transmission or are linked together in some way. Epidemiological clustering is based on epidemiological data, which I'm not an expert, but for example where people live, who they associate with, certain risks they have for possibly having a disease. Actually the power of genomics comes from

bringing those two things together, so that we can infer potential cluster or we can demonstrate clustering at a genomic level and then link in that with epidemiological data, allows us to provide very strong inferences of how a disease is transmitting or moving.

Q. Just isolating the genomic factor you said before, you can tell --- my term --- relatedness between two samples, two people who are infected, but that of itself, even if it is closely genomically related, doesn't allow you to say who infected who. That is, the direction of infection?

A. For some pathogens, that can be suggested. But for in particular for SARS-Cov-2 the answer is no, we can only say that the genome sequences tightly cluster, it is likely that these cases have links to each other, and then the epidemiological data can support that hypothesis by demonstrating that, yes, these two cases were in contact with each other and it supports that the hypothesis that the disease did spread between those cases, but the genomic sequencing alone cannot draw that conclusion.

Q. For the purposes of understanding that genomic closeness or relatedness, could I ask you to look at your statement? Could we bring up figure 1, paragraph 46 of Professor Howden's statement.

Professor, here you are indicating graphically the idea of a phylogenetic tree?

A. Correct.

Q. As I understand it, we should try to look at the diagram you have given working from the left to the right ---

A. Yes.

Q. --- to understand it. But perhaps it would be easiest if I ask you, you identify sequence A, B, C and D in that diagram. Can you tell us or explain to us how those sequences --- how they develop and how they are related to one another?

A. Yes. So the phylogenetic tree is a very important sort of visual representation of the genomic and bioinformatic analysis that we do of the genomic data to compare samples to each other. What it does is visualises evolutionary relationships between samples. What I'll do is just explain it in the simplest terms I can, but if you look at sequence A and sequence B, they are two genome sequences we have of a particular sample. The distance between them on the horizontal lines is the genomic distance between those samples. So that if you look at the figure, sequence A has a much shorter horizontal distance from sequence B, compared to either C or D. That means that sequence A is much more closely related at a genomic level to sequence B than it is to sequence C or D.

What we can then use, is these trees allow us to sample down to the point where we can cluster things that are very closely or identically related to each other. If we had

a sample on this tree for example that was identical to sequence A, you would see a vertical line attached to sequence A that would have that sample on it, demonstrating no horizontal difference between it and another sample and that would suggest none or almost no sequence difference between the two samples. So, in essence, this tree is really a visual representation of the genetic distance between samples. Just to go over it again, the horizontal branch link is the distance between samples measured essentially by the mutations that we detect in a sequence data. The shorter distance between sequence A and sequence B shows that these samples are more closely related at a genetic level than they are to sequence C and D, whereas C and D are more closely related to each other than they are to sequence A and B.

Q. Each of those sequences is showing a common inferred ancestor. Can you explain the process by which the tree branches, and I think your way of describing it is that each of sequence dots is the leaf on the tree?

A. Yes.

Q. Each of those sequences has emerged as a separate branch, going back to the common ancestor. How does that process work?

A. The leaves are the samples that we have available to interrogate for their sequence data, whereas inferred ancestor is a sample that we don't necessarily have, but the principle is the inferred ancestor will have common mutation, for example, for both sequence A and sequence B and then each of those will have additional mutations that allow them to be separated on the tree. If no additional mutations had incurred, then that inferred ancestor --- the sequences of A and B would be the same as that inferred ancestor. So essentially the inferred ancestor is that common point where those two sequences have the same set of mutations on them. Subsequently they have diversified and developed different mutations.

Q. We have heard for some time about the idea of strains of the virus. Is that something that in this context is useful for your purposes?

A. There is an international nomenclature emerging on different lineages of the virus. They are higher level descriptions of viral sort of branches and images but they are not particularly useful for what we are doing, which is clustering for the purposes of public health understanding of transmission networks and links between cases. So those higher level descriptions of lineages are available and are important on a global scale, but for the work we are doing, we do not need to use those for the purposes of liaising with them or reporting to the Department of Health.

Q. Does that mean when we talk about a strain from a geographic area, that's the sort of concept we are talking about there, a higher level?

A. Yes, that's correct, yes.

Q. Could I ask you to explain the collaboration that happens between your unit and

the Department of Health and Human Services for the purposes of trying to understand the COVID infection in this community?

A. Certainly. The genome sequencing laboratory that I'm director of is funded by the Department of Health and Human Services and we have a close partnership to establish and use genomics for public health purposes in Victoria and that's for a whole range of pathogens. When COVID-19 emerged we transitioned to sequencing and analysing the pathogen as soon as we could and we have been meeting regularly with the Department of Health and Human Services epidemiology team at least on a weekly basis, often more frequently, to share the results of the genome sequence data, discuss and understand the implications of that data and then write reports on that data so that the Department of Health and Human Services can better understand the emergence and spread of this pathogen in Victoria.

Q. That figure 1 can be taken down.

Is it putting it too simplistically to say that your unit is doing the raw science and DHHS is then doing the detective work?

A. In some ways that's correct. We're doing the --- doing genomic sequencing and analysing the data is complex and in many ways cutting edge science, but it's been brought into real public health practice now through this sort of approach. The science of epidemiology is incredibly important, but bringing those two together leads to a much greater understanding of what is happening in the community or what is happening in Victoria and then the Department obviously has to act and make decisions about public health based on that information. So we are contributing to the understanding and ultimately to the decision making around the control of this pandemic in Victoria.

Q. If you understood my analogy to be diminishing your role in any way, it wasn't intended, I can tell you that. So is it correct to say through genomic sequencing and clustering you can come to a conclusion that people who are infected exhibit a very similar strain, genomic sequence, one to the other, but what you can't do is tell whether one gave it to the other or even if one gave it to the other?

A. Using the genomics alone we could never say that, that's correct, because we don't understand that epidemiological information that gives it plausibility. If we --- I'll give you an example, if we had a genome sequence from two samples, it was identical, we would discuss that with the department and say these genome sequences look identical, I would be highly suspicious that there is some sort of link in transmission here, and the department might have information to say, these two people live in the same household, they haven't been out for a month, there is no one else they could have caught it from and that would close that loop of understanding about transmission, but it wouldn't necessarily say who got it from who because the directionality is not --- there's no signatures in the directionality in the genome data, but there may be in the history of the symptoms, if one person had been sick two weeks earlier and the second person got sick two weeks later, then you could infer

that it's the likely direction of transmission through that sort of approach.

Q. So that intelligence allows some inference of familiarity, or the direction of transmission?

A. Some inferences, but given the complex nature of transmission of this virus and the fact that asymptomatic transmission can occur and the infected period can be quite long, you'd need to be careful about drawing those conclusions, but that is more of an epidemiological question.

Q. Yes. Paragraph 91, you were asked about the percentage of Victorian cases you were able to sequence and over what range. You tell us there that as at 29 July sequence data was available for 46 per cent of Victorian COVID cases diagnosed up to and including 23 July.

A. That's correct.

Q. Perhaps we can bring up figure 2, which appears at page 17. This is graphically representing the number of diagnosed cases that you have been able to, over time, genomically sequence; is that right?

A. That's correct. What we can see here is the green ones are the samples that are included in the analysis, so they have had a genomic sequencing performed and it passes our QC metrics. There is a small number in blue, that's at the start of the pandemic, where a sequence was not available and also a small number that did not pass QC criteria, to be included in the analysis. You can see the line up the top gives the --- a portion, the accumulative portion of cases that had a genomic sequencing available at the date of this data. You can see that for most of this time period it is at 80 per cent or above, it is just when the case numbers became much larger. At the end of this figure, you can see the proportion that dropped off at that point, because there was still work to do to finish off the sequencing for those additional cases.

Q. That is simply a case of the number of diagnosed cases more than your capacity to keep up with the sequencing?

A. There is a limit to the number of sequences that could or should be run on a weekly basis. Certain a few hundred to a thousand of them can be easily achieved, but when the case numbers were 700 a day, that made it more challenging.

Q. As of 29 July, you say at paragraph 95 of your statement that 65 genomic clusters had been identified, and that is a graphic representation in figure 3, at page 19 of your statement.

Professor, I'll ask you perhaps to explain what we are looking at here in terms of --- perhaps if we can start with what we see on the X axis across the bottom?

A. Yes. So what we have done here is take --- because we now have thousands of

cases available in the phylogenetic tree, and so to look at that and interpret that is incredibly complex and actually not achievable to look at it as a single figure. What we have done is summarised that data into a single image that, over time, gives a sense of what is happening with the different clusters in Victoria. So just to give some information, the X axis is time, so you can see back from the first case that was sequenced back in February of 2020, up until 10 August --- or 14 August is the date on this particular image. Then on the Y axis is the genomic cluster that we have defined, so that's been defined through well-validated bioinformatic approach for identifying the genetic clusters.

Q. Is there any significance to the attribution of 28A or 33B to those ---

A. No, the numbers are completely arbitrary and they don't infer any relevance on one cluster to another.

Q. If I can start at the top of the graph on the Y axis, there's a --

CHAIR: I know you have already asked --- let me ask again whether or not we can zoom in closer to the top half of that document, please.

MR NEAL: Working from the top left-hand, "Not available", there is a horizontal line with lots of dots. Can you tell us what that means?

A. The horizontal line is just there for --- to help with interpretation. Each dot represents a case. "Not available" means there is no genome sequence available for this particular case. I guess we can't see the legend at the moment but just to clarify, the orange is the travel --- thought to be a travel-associated case and the grey/black is thought to be a locally-acquired case in Victoria. So, as I said, the data across that top line is where there is no genome sequence data available for analysis. You can see that at the right-hand end, the most recent data, there is a lot of cases then. That's because of the large number of recent cases and the fact that the sequencing is catching up to this number of cases. The other ones seen throughout that whole time period are cases, for example, where the sample was no longer available to be referred to our laboratory for sequencing or the sequencing was not able to be achieved, for example, if there was very low amounts of virus in the sample.

Q. The next entry on the Y axis under "Not available" is "Did not pass QC". That is quality control, I imagine?

A. Yes. What we have done, because we work under a strict quality control framework in the Public Health Laboratory, we have set some minimum quality standards for each genome sequence if it's going to be included in our analysis and again there's a number of these that did not pass this quality control metric and, again, this is most often because there's low amounts of virus in the sample, and therefore the sample wasn't able to be sequenced very adequately and we would therefore rather exclude that from the analysis rather than drawing inappropriate inferences based on poor data.

Q. In the middle of the graph there's a vertical dotted line. What's the significance of that?

A. That dotted line essentially summarises the point at which all the early clusters that we identified, early in the outbreak in Victoria, appeared to have essentially disappeared. It is actually the bottom half of the image.

Q. Can we zoom to the bottom half, please?

A. So that dotted line is in early May, it is a little bit hard to see on the image, but what you can see there is a large number of clusters, so we've got transmission network 1 --- I'll get on that in a moment --- but under that, there are a large number of clusters with quite a lot of suspected overseas acquired infections in orange. These clusters have a range of case numbers in them, they all essentially, except for one or two, have a mixture or were all potentially overseas acquired and by early May they have all essentially disappeared from the community in Victoria.

Q. Looking again on the Y axis, we go at the very bottom to 37A, up to 31K, as I understand it. They are the cases which you say the horizontal line for each of those, does it represent in itself a cluster?

A. Yes. Each of those cluster numbers is a unique cluster, so right down the bottom, 37A is one cluster, 26B is the next cluster, they are not related to each other. What we have done is shown --- we are using that horizontal line just to highlight that those dots that are linked to each other for each of the clusters, given the complexity of the data we are trying to demonstrate. It also gives you a sense of the time period for which that cluster was present.

Q. I think your statement refers to those as being, in number, 44, I think, diverse clusters. Can you be clear about what you mean by diverse clusters?

A. I guess what we are saying here is that the large number of different clusters, all present at the same time. So if you look at late March, almost all of those clusters we are talking about there, they're below transmission network 1, so from 31K down to 37A, it seems that all of them were present in the state at that time, so we had diverse clusters, a large number of diverse clusters present in Victoria at that point in time. I guess the most relevant thing here is that, as I said before, almost all of them have cases in there that are orange, suggesting that they have been imported from overseas, which fits with what was happening with the epidemiology in Victoria at the time, people returning from overseas bringing the virus with them and small clusters evolving as part of that process.

Q. Is that to say, then, that in that area of the graph we are talking about, 44 single importations of the virus into Australia or into Victoria?

A. That's correct.

Q. That accommodates the period up to about 8 May. If we go back up to transmission network 1, we have transmission network 1 there and two clusters, 17A and 7A, all of which appear to be black dots. What is the significance of that?

A. This, looking at the data here, is a transmission network. What we mean by that is it's a cluster that has evolved and persisted in Victoria and then led to a subcluster that sits within it. Essentially, transmission network 1 can be considered one large cluster, it just has some --- it's evolved --- it's been present long enough that the genomic signatures are the subcluster emerging within it, that that could be relevant for epidemiological purposes. Therefore, we give that designation of a second cluster within it. But, essentially, this is a cluster that was present from right in the middle of the initial outbreak in Victoria, peaked just towards the end when all these other clusters were disappearing, then has not been seen for --- I think the last was late May/early June was when those cases were last seen in that cluster. There is no overseas case that we have noted in that cluster and that may be because there wasn't --- for example, there may have been an overseas case that --- where the sample was not available for sequencing or where the sample did not pass QC and was not included. In most cases we do see that link between the overseas and the locally acquired cases. In this particular case we don't have that overseas acquired case as part of that network.

Q. Do I understand correctly that 7A and 17A are closely genomically related?

A. Yes, 17A is derived from 7A. So 17A has all the signatures of 7A as a genomic cluster that was first present and then some additional mutation or more that has allowed a subcluster to be designated. These transmission networks could be collapsed into a single cluster, but for reporting purposes to the department it's more useful to demonstrate those subclusters that are emerging because they could have epidemiological importance, but it is very important to note that all these transmission networks, the initial cluster is thought to be the initial recognition of the importation and all subsequent clusters within these networks are derived from that original cluster.

Q. On the face of it, that cluster has --- or that network has died out?

A. Yes, correct, based on the sequence data we have available.

Q. If we could then move to what is called transmission network 2, that network appears between the horizontal lines above "Transmission network 2" down to above "Transmission network 1". That's the way it works.

A. That's correct. This transmission network 2 has the majority of cases that we have seen since early June. If you would like me to describe the characteristics of this network.

Q. Yes, if you could start with the earliest of the orange dots, perhaps.

A. Yes. This network, the first cluster identified in this network is called 15A. You can see on the horizontal line that there are a number of international travellers who had sequences in this cluster and this was subsequently followed by a number of apparently locally acquired cases because there was no documented overseas travel. This is all within 15A. You can see that 15A is still persisting to the latest data available with a very large number of cases in there but also a number of subclusters have emerged from this original 15A cluster such that we now have a lot of additional subclusters designated within this transmission network 2.

Q. All those clusters nominated above 15A up to 79A, you are saying, in terms of their genomic sequencing, they are closely related?

A. Closely related and they are derived from 15A.

Q. Could I ask you similarly to go to transmission network 3, which appears to involve 58A and 22A.

A. Yes. This is a similar story here. There's an initial apparent overseas acquired infection at the start of 22A and a number of apparent locally acquired cases. There's not --- compared to the other transmission network there's not a large number of cases but there has been some diversification such that there is a subcluster 58A that sits within this broader transmission network.

Q. Similarly, 45A.

A. Yes, 45A is again a very similar story. This time we have not designated any subclusters so it has its own cluster name of 45A. Again, a number of apparent travel-associated cases at the start of the cluster and then a dominance of apparent locally-acquired cases after that.

Q. In terms of the confidence scientifically you have that the clusters that we are looking at, in the transmission networks 2, 3 and 45A in particular, what sort of confidence do you have that the genomic clustering that is represented there is accurate?

A. Yes, we are incredibly confident about the accuracy of that clustering. The way we do our bioinformatics analyses is that we use statistical approaches to derive a confidence around the clustering that we infer. That could be sometimes called a bootstraps support. For example, for cluster --- network 2 we had 100 per cent bootstraps support for the original cluster 15A. What that means, that's a probability that that cluster exists, so we essentially have 100 per cent confidence that that is a discrete cluster. For transmission network 3, it was 98 per cent and for cluster 45A it was 100 per cent.

Q. What would be a percentage which would cause you to doubt that you have got it right?

A. Anything over 85 per cent is quite good confidence. But anything --- something that is 98 or 100 per cent is incredibly high confidence, obviously.

Q. In your opinion, what does the information contained in transmission networks 2, 3 and 45A enable you to say about the presence of community cases in Victoria at the moment?

A. We can't say --- we don't have the epidemiological data of what each of those cases are. What I could say, a high level statement, would be that over 99 per cent of all current cases in Victoria for which we have genomic sequencing data are derived from transmission network 2 predominantly, as well as transmission network 3 and cluster 45A, such that essentially all current cases, bar a few, are from those transmission networks and that cluster.

Q. Can I ask you, are there limitations on the reliability of your findings?

A. There are some limitations with genomic sequencing, the main one being the sampling. I think I alluded to that earlier, that we have not sequenced all samples at that time and there are some samples for which sequence data is not available or doesn't pass quality control so there is no risk that we may be missing some genomic signal in the data. Otherwise, I'm very confident with our results. We have done internal validation of our approaches and show that our genomic clustering approach maps very well to epidemiological data, we have very robust in reproducing the sequencing approaches and we are incredibly unlikely to include cases in the same cluster if they are not epidemiologically linked.

Q. Given that the sequencing is incomplete in relation to cases in Victoria, is it the case that you would --- let me put that another way. Have you so far come across any of the current cases which don't belong to the cluster, the clusters you have identified?

A. Yes. Only --- you can just see at the bottom of the figure, 31K, there's that cluster and then one below it, where there are four cases since June, since that transmission network 1 ceased, there's only four cases that don't cluster in one of these --- either in network 2, network 3 or 45A. So there's an incredibly small number of what you might call sporadic clusters, that is unexpected, but they haven't persisted and this doesn't appear to be ongoing transmission from them.

Q. Is it the case that you would have expected to see unrelated clusters if they do exist in Victoria at this stage, given the percentage of sequencing that you have done?

A. I think we have one of the most comprehensive sequencing programs in the world in terms of the proportion of cases sequenced, even though the number has dropped with the recent increase in cases. I would say that we are very likely to pick up additional clusters as they emerge. But we have not yet sequenced all of those cases,

so there is a chance that additional clusters could be identified through the sequencing of new cases. But they have previously been linked to international importations and the risk of --- the number of international cases appears to have decreased in Victoria, so I doubt there will be many additional clusters but I cannot be certain of that.

Q. Are you talking of clusters that are unrelated to either networks 2, 3 or 45A?

A. That's correct, yes. Apologies if I wasn't clear. I believe the majority of cases that are yet to be sequenced fit within those clusters, but we can't be definitive on that until the sequencing is complete.

Q. Is that the case because, given the percentage that you have done to date, you would have expected to have seen other clusters if they exist?

A. Yes. What we have done today, 99 per cent, or more than 99 per cent fit within those clusters we discussed, network 2, network 3 and 45A. I doubt that proportion will change much. But as we go along in time, there is a risk --- obviously there is a possibility that a new cluster could be introduced through another mechanism and we may detect that. But for the current situation, it is very unlikely we will be detecting many samples that fall outside these clusters.

MR NEAL: Thank you. I don't have other questions for Professor Howden.

CHAIR: There wasn't any other applications for leave with respect to Professor Howden, was there, Mr Neal?

MR NEAL: None that were persisted with.

CHAIR: Thank you, Professor Howden, thank you for your attendance. You are now excused.

A. Thank you.

THE WITNESS WITHDREW

CHAIR: That brings us conveniently to the end of the sitting day. Mr Neal, I understand that the witness for tomorrow is Dr Alpren, indeed the epidemiologist that will bring the epidemiological evidence that Professor Howden has been referring to throughout his evidence this afternoon.

MR NEAL: That's correct.

CHAIR: We will finish the day, adjourn now until 10.00 in the morning, if there is nothing further, Mr Neal.

MR NEAL: Perhaps because Professor Howden provided us with the updated version of figure 3, which doesn't appear in his statement, that perhaps should be exhibited.

CHAIR: Separately?

MR NEAL: Separately exhibited, yes. Figure 3 is the sequence data reported to 14 August 2020. That is the document to which he referred. His report was only to 29 July 2020.

CHAIR: Thank you. I will mark that Exhibit 7.

EXHIBIT #007 - FIGURE 3 SEQUENCE DATA REPORTED TO 14 AUGUST 2020

CHAIR: We will otherwise adjourn now until 10.00 tomorrow. Thank you.

HEARING ADJOURNED UNTIL 10.00 AM ON TUESDAY, 18 AUGUST 2020

Index of Witness Events

Index of Exhibits and MFIs