Witness Name: John Watkins

Statement No.: M1/WATKINS/01

Exhibits:

Dated:01/06/23

## **UK COVID-19 INQUIRY**

#### WITNESS STATEMENT OF:- Professor John Watkins

#### Statement of Truth

I believe that the facts stated in this witness statement are true. I understand that proceedings may be brought against anyone who makes, or causes to be made, a false statement in a document verified by a statement of truth without an honest belief of its truth.



Dated: 1st June 2023

# Module 1 of the UK Covid-19 Public Inquiry ("the Inquiry") Request for Evidence under Rule 9 of the Inquiry Rules 2006 - Reference for Request - M1/WATKINS/01

# 1. Professional Background and relevant experience concerning Pandemic preparedness.

I am a Consultant Epidemiologist on the Specialist Register of the GMC (Number 2730372) and the GMC register as a GP. For over 30 years, I have worked in the field of Epidemiology with a special interest in the epidemiology and prevention of illness due to respiratory pathogens, particularly Influenza in its seasonal and pandemic forms. I have conducted research and published on all aspects of Influenza, influenza vaccination, surveillance systems and pandemic disease. I have published on these topics in international peer reviewed journals and presented at major international conferences relating to Influenza and other respiratory diseases, particularly the Options for the Control of Influenza conferences, (since the second conference in 1992) and the a number of ESWI conferences. *1,2,3,4,5,6,7,8,9*. Of relevance to this statement would be the findings presented to the Options meeting that took place in 2003 when the initial findings from the original SARS epidemic were presented by the clinicians and scientists with first-hand experience of the cases.

In relation to pandemic Influenza and pandemics in general, I presented one of the first papers on the impact of the 1889 'Russian Influenza' pandemic in London in 2006<sup>2</sup>, which was subsequently elaborated on in Toronto in 2007. Also in Toronto, I presented a paper on Age as an independent risk factor from pandemic influenza. <sup>10,11.</sup> (**INQ000211746**)

In 2006, I wrote a discussion document for the lead for Pandemic Planning, David Goulding, at the Welsh Government, the subject of which was an option appraisal for Call Handling and the healthcare response during a pandemic (**see references** <sup>6,8,9</sup> **below**, see also **INQ000211737**) In the document my advice was that, in the event of a pandemic, we largely continued business as usual, using routine systems for both the triage of cases and the administration of anti-viral therapy, while building in contingencies for escalation. A path we followed with the relatively mild pandemic of 2009.

In 2007, I reviewed the findings of the 'Winter Willow' exercise and the repercussions of its findings for Wales.

During the 2009 H1N1 pdv Pandemic, I was a key adviser to the Welsh Government on its response to the pandemic and took part in most of its policy discussions. Between 17th and the 20<sup>th</sup> November 2009, I was invited to take part in a meeting, held in Geneva, organised by the WHO Global Influenza Program, which involved some 200 scientists and policy makers from around the world. The aim of this meeting was to formulate policy on the Global Research Agenda for Influenza, which was subsequently published, to date it has received over 4000 citations<sup>12</sup>.

In more recent times, I have worked with colleagues across Europe and published a number of papers comparing Influenza surveillance systems across Europe<sup>13,,20</sup>.

Prior to the 2009 H1N1pdv Pandemic, I had worked closely with both the UK and Welsh governments on pandemic preparedness and vaccination policy, at one stage chairing the winter vaccination group in Wales.

In 2013, I presented a paper at the Options for the Control of Influenza conference in Cape Town which addressed the use of R (the basic reproductive number)<sup>14</sup> (INQ000211746) in Influenza research and, in 2014, at the ESWI Influenza Conference in Riga, I presented a paper on the role of network structure on the propagation of disease in the real world and the implications this has for pandemic planning<sup>15</sup>. Both these topics have relevance to the way in which the UK modelled the evolution of and responded to, the COVID-19 pandemic.

From 2012, I took part in almost all of the meetings of the Welsh Pandemic Influenza group, which met, from 28<sup>th</sup> June 2011 to 9<sup>th</sup> July 2018. I will comment on the issues discussed and outcomes later in this statement. **(INQ000211731-INQ000211711, INQ000211720-22, INQ000211725-26, INQ000211726-36, INQ000211743-45.)** 

## 2. Documents used in preparation of this Statement

In preparation of this statement, I have consulted the following documents;

- Reports by WHO, The Lancet and other journals, on Deaths from the original SARS outbreak <sup>18</sup>
- Report on Exercise Winter Willow 2007
- UK Pandemic Preparedness plan 2011 (INQ000211743) <sup>16</sup>

- UK Pandemic Plan Ethical framework 2013 (INQ000211743) <sup>17</sup>
- Deidre Hine review of 2009 pandemic (INQ000211738)

Meetings of the Welsh Pandemic Influenza group that took place between 2011 and 2018, on the following dates; 28<sup>th</sup> June 2011 – Task and Finish Group 17<sup>th</sup> January 2012 11<sup>th</sup> March 2013 13<sup>th</sup> November 2013 20<sup>th</sup> March 2014 29<sup>th</sup> April 2015 25<sup>th</sup> September 2017 29<sup>th</sup> January 2018 9<sup>th</sup> July 2018 (This was the last meeting of the WPIG before the 2020 COVID-19 Pandemic) .

# (INQ000211731-INQ000211711, INQ000211720-22, INQ000211725-26, INQ000211726-36, INQ000211743-45.)

- Report of Wales component of Project Cygnus October 2014 (INQ000211719)
- Local Resilience Forum Plans for the Health Board Areas of Wales published between 2013 and 2018 (**INQ000211697-707**)

#### (All of the above documents are held on file.)

## 3. My personal involvement

For the period of interest to Module 1 of the COVID-19 Enquiry, i.e. 2009 to 2020, I was actively involved, both from a research and formation of policy point of view, within Wales, the UK and internationally, with regard to pandemic planning. As outlined above I attended a workshop hosted by the WHO, in 2009 that set the Global Agenda for Influenza Research<sup>12</sup>. Throughout this period I published work on Pandemics, Surveillance systems and mathematical modelling, see references below. I attended all meetings of the Wales Influenza Pandemic Preparedness group from 2012 and gave a keynote talk at an Influenza Pandemic planning Workshop, hosted by the Welsh Government, in Llandudno in October 2013. (INQ000211715-717)

Prior to the 2009 pandemic I worked with the Welsh Government to review the findings of the Winter Willow exercise, I wrote an options paper for the government on how the health service could respond to a pandemic and this was discussed at an early pandemic planning meeting. **(INQ000211737)** 

Post the 2009 H1N1 pandemic, I and others from Wales, had several meetings at the Department of Health in London to develop the UK pandemic plan, published in 2011<sup>16</sup> and continued to have contact with colleagues in England and the other devolved nations. I also took part in annual 5 nations meetings on Influenza that were organised via a UK and Ireland Health Protection surveillance network that reviewed past seasonal activity, shared data and planned for future developments. I linked with GO Science Office in London with regard to the planning assumptions and modelling that were debated at SPI-M concerning school closures. (INQ000211749-51)

# 4. My assessment of the engagement of Welsh Planning with England and other devolved nations.

As set out above, throughout the period of interest of this request for a witness statement, there was, in the early years, very active engagement between the nations of the UK, which resulted in the UK Pandemic Plan<sup>16</sup>, and the Ethical framework <sup>17</sup>. Within Wales, the Pandemic Influenza group had two periods of regular meetings, 2011 to 2014, followed by meetings in 2015, 2017 and 2018. .(INQ000211731-INQ000211711, INQ000211720-22, INQ000211725-26, INQ000211726-36, INQ000211743-45.)

In the immediate aftermath of the 2009 pandemic and in the formative stages of the UK plan, the key findings, from the discussions, that helped guide local plans included; *(for more details see documents referenced above, minutes, agenda, LRF plans etc.* INQ000211731-INQ000211711, INQ000211720-22, INQ000211725-26, INQ000211726-36, INQ000211743-45.)

- Development of Enhanced Surveillance Systems
- Development of a proportionate response to a pandemic, based on emerging epidemiological and pathological findings, one size does not fit all pandemics.
- Recognition of the need to develop a framework for the clinical impact, gleaned from elsewhere and the first 100 cases in the UK

- A recognition that the age specific attack rate would differ from seasonal influenza. I highlighted the fact that in each of the last five pandemics the attack rate/fatality rate was worse in young adults than in other age groups, the elderly protected by prior immunity acquired, often in childhood, during a previous pandemic era<sup>10,11</sup>.
  (INQ000211746)
- Stockpiling of drugs, PPE etc.
- Surge capacity in health and social care
- Planning for the management and storage, of potentially very high numbers of bodies, which are expected to accumulate in a pandemic and overwhelm local undertakers. It was recognised that local authorities had no legal framework to handle the storage of the dead, as this was the domain of independent undertakers.

The newly published, circa 2011, pandemic plan<sup>16</sup>, **(INQ000211743)** recognised some of the failures of the system in the 2009 H1N1 pandemic and identified that with a rapidly spreading virus trying to contain disease spread would be futile and divert resources away from management of the pandemic. The new plan called for

- Detection- Enhanced surveillance to detect the arrival of virus within the country and monitor the spread to and within, regions
- Assessment case finding and case definition/ severity (first 100 cases)
- Treatment deployment of antivirals, via normal services till these were overwhelmed
- Escalation where normal services were cut back, or curtailed e.g. routine surgery etc.
- Recovery- when systems start to return to normal

What was striking about the 2011 plan, compared to what took place in 2020, was that the plan counselled, mostly, AGAINST; school closures, the broader use of face masks outside the clinical setting of aerosol generating procedures, border closures and lockdowns. This, stance was taken based on scientific evidence, as to the effectiveness, or not, of these non-pharmaceutical interventions and recognising that the rapid spread of the disease would make limiting the movement of people futile. These findings were mostly reinforced in the

years that followed and within SPI-M, at their meeting on the 5<sup>th</sup> February 2018 relating to school closures and at other meetings relating to data requirements. **(INQ00021179, INQ000211752)** 

Non-pharmaceutical interventions, such as broad society lockdowns and school closures for an Influenza pandemic were considered to have insignificant effects, as were, track, trace and isolation, in the case of a rapidly spreading virus.

The broad characteristics and nature of the epidemiological spread of a coronavirus, such as SARS-CoV-2, are similar to the pandemic spread of Influenza A considered in the Pandemic planning and based on historical experience. That is;

- rapid spread through the community,
- large number of asymptomatic cases,
- high levels of morbidity and mortality,
- the need to have resilience in the health and social care system in order to cope with increased levels of morbidity and mortality.
- It was also noted that contingencies needed to be made to stockpile PPE,
- have plans in place to deal with the storage and burial of the dead.

All of these were considered and deemed necessary for Pandemic Influenza and would, if implemented, stood the test of time with SARS-CoV-2.

Lockdowns, Social Distancing, Restriction of Movement, limiting the numbers who were allowed to meet privately, or at large, were not necessary unique features for the control of the SARS-CoV-2 virus in particular, or coronaviruses in general. In fact, in my editorial in the BMJ published in February 2020 (INQ000217261), I called for thinking beyond containment as I felt we had passed the point where we could stop the spread of this disease.

It is not as if, when we discussed pandemic planning on a UK wide basis, that we did not consider these non-pharmaceutical measures but it was felt that they would have little benefit in a country such as the UK, or other western democracies and the harms outweighed the benefits. This would have been true no matter what the nature of the viral pathogen. It is easy, in hindsight and with the conviction that 'lockdowns' were the right thing to do, to suggest that they were a unique feature of a coronavirus pandemic which should have been thought about. This was not the case. Political decisions, based on

expediency/panic to be seen to do the right thing, threw out/failed to read, the advice that had gone before and made a knee jerk decision to precipitously follow the Chinese example and plunge the UK into lockdowns and the closure of international borders and restriction of movement of people. It was not that the Pandemic Planning in the years 2009 to 2020 had not considered all of the above, or ignored the fact we could face a coronavirus pandemic, on the contrary it was felt that the focus was on resilience and protection from the inevitable, not trying to hold back an uncontrollable tsunami.

From 2013 to 2015, planning took place with the expectation that Project Cygnus would run in the October of 2014. There was a planning meeting for this, in Wales, on the 14<sup>th</sup> May 2014 and while the broader Exercise, across the UK, did not take place, all four Local Resilience Forums, LRFs, in Wales, took part. The workshop focused on the healthcare arrangements in the detection and assessment phase.

The key findings were; . (INQ000211719)

- The need to keep schools open wherever possible
- Development of and access to, national stockpiles of drugs, PPE etc. (it was reported to the Pandemic Influenza group, meeting on the 11<sup>th</sup> March 2013, that stockpile facilities had been secured). (INQ000211695)
- The need to develop plans to deal with and store those who had died when the normal system of undertakers had been overwhelmed.
- It was discussed how death certification could be foreshortened
- Care home capacity was seen as a particular area of concern and also their ability to cope and protect residents
- It was raised in a pre-meeting for Project Cygnus that data links needed to be established between the Welsh Government and Public Health Wales to monitor the pandemic.
- It was decided that a sub group would be set up to look at vulnerable people. I am not aware that this took place.
- When, during the pandemic, vaccine became available, the issue was raised as to who would vaccinate and how this was arranged.

At the Wales Pandemic Influenza Meeting, on the 29<sup>th</sup> April 2015, . **(INQ000211721)** a checklist was presented against which to gauge the Local Resilience Forums' plans. It was confirmed that all these plans had been completed. In addition, this meeting confirmed that a

data dashboard had been established within Welsh Government and I reported that the systems were in place to continue the capture of data from GP systems on a daily basis (this process had been in place for a number of years and this was to reinforce that the new system was robust and could provide the information needed.). In addition, I reported that we had set up, within PHW, routine surveillance within a number of ICU's across Wales that would give us routine multiplex, PCR, surveillance for a battery of respiratory pathogens including Influenza, RSV etc.

From 2018, the Welsh Pandemic Flu Group engaged with the DoH in England in drafting a Pandemic Influenza bill, which would lay dormant, on the statute books, until it might be needed and/or the UK pandemic plan was reviewed. . **(INQ000211732-36)** One of the issues raised, within the proposed Bill, was the definition of 'At-Risk' individuals and I argued that a more nuanced approach was needed for this, influenced by the clinical impact of a pandemic virus, cf., age-based differences between seasonal and pandemic influenza. Often, in an Influenza pandemic, the normal 'U' shaped curve in mortality with the very young and the elderly being most affected, is replaced by a 'W' shape, with a disproportionate number of deaths occurring in young adults and those in the middle years of life<sup>10,11</sup>. The elderly often protected from severe disease by immunity gained by prior pandemic exposure. I also raised the issue of the licensing of drugs in a pandemic, using the example that Oseltamivir, an antiviral for children against influenza, which is stockpiled in powder form, in large containers and has to be reconstituted to be used. This process requires a dispensing license. We also considered a draft from the Department of Justice on the pandemic policy in prisons.

#### 5. Pandemic Preparedness

Outlined above is an overview of the processes and engagement, on pandemic planning, in Wales, upwardly to the DoH and the other devolved administrations and down towards local planning structures, within health and local government. However, as expected, over an extended period of time, such as between 2009 and 2020, the personnel involved in the planning process, outside of the Welsh Government, changed dramatically and LRF engagement was not always consistent, or present.

In addition, following the 2009 pandemic, the UK saw a number of winters with increased influenza activity. In particular, the winter of 2012/13, brought the NHS in Wales to the point of collapse, the word unprecedented was used to describe the chaos within health, and social care, as the systems struggled to cope with demand. Politicians sort to blame the

convergence of severe winter weather with increased respiratory viral activity. However, in a study colleagues and I carried out in June 2013, we found that the cause was not in fact related to either Influenza, or the winter cold, per se, it was in fact a product of the gradual running down of secondary care facilities, mostly beds and a failure to increase the size of the NHS workforce in line with the demographic shift. This shortfall in staffing and resources meant that the NHS was far less resilient in 2013 than it had been in 2000, the last period of increased flu activity, outside a pandemic. (INQ000217263)

This last winter, December 2022, was again described as unprecedented, however, I recently carried out a follow up study, of the one described above, which demonstrated that there had been a further erosion of the bed estate, within the NHS in Wales, since 2013 and a significant reduction in the number of GPs.

It is therefore not surprising that when the pandemic hit in 2020 the NHS was not in good shape to cope. (INQ000217262)

The funding and structure of health and social care between the years 2009 and 2020 had not been increased to cope with the threat of a pandemic and actual acute bed numbers had been reduced, hence the forced discharge of elderly people to care homes during April and May 2020 was needed to free up capacity.

#### 6. Lessons from the Original SARS outbreak 2002 to 2004

In 2002, the original Severe Acute Respiratory Syndrome, SARS, was caused by a coronavirus that jumped the species barrier from bats to humans, via an intermediate animal host, the resulting spread of this virus, human to human, infected over 8,000 people and resulted in at least 770 deaths worldwide<sup>18</sup>. In 2012, a second coronavirus appeared to again jump the species barrier and infect humans, while the transmission dynamics of this MERS-CoV virus were such that the risks to humans was classified as low due to a very low person-to-person transmission rate.

What is clear, firstly from the original SARS cases and the subsequent MERS-CoV zoonotic events, is that coronaviruses can infect humans and be transmitted from person to person, in the case of SARS, giving them pandemic potential. We learnt from SARS and MERS-CoV cases that, while the majority of infected individuals were asymptomatic, those that were infected had high morbidity and mortality. In the case of SARS, the major risk factors, for

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severe outcomes, were known in the 2002 to 2004 time period, i.e. those who were elderly and those with a high-risk condition, having a much higher risk of death and severe illness than younger healthier people.

At no point, in any discussion at a UK, or Welsh level, when talking about pandemic planning did the known facts of a coronavirus pandemic impact discussions, i.e;

- It was known that the majority of cases infected with SARS and MERS-CoV, could be asymptomatic and this would have huge implications for containment and mitigation. At the start of the 2020 COVID-19 Pandemic, before the WHO had declared it as such, I pointed out, in an editorial published in the BMJ in February 2020, that asymptomatic spread was highly likely, this publication has, to date, received over 400 citations<sup>19.</sup>
- It was know that there was a potential latent period between infection and symptoms, with maximum viral replication and hence infectivity, occurring 24 hours before to 24 hours after symptoms develop, again making case tracking and containment impossible with a rapidly spreading, highly contagious virus.
- It was known that age was the major determinant of death and yet this was not discussed and significant actions taken to protect those most at risk, the elderly and the infirm.

The focus, internationally, on the search for treatments and vaccines against coronaviruses, essentially stopped in 2006 when research funds dried up for this line of investigation and hence, many years of vital knowledge, that would have prepared us for the 2020 SARS-CoV-2, pandemic were lost.

At no point during pandemic planning at either the UK, or the Welsh Government level, were the significant, clinical, epidemiological and demographic differences between pandemic influenza and one caused by a SARS like coronavirus discussed, or planned for, as far as I am aware.

## 7. Creation of Nightingale Hospitals

In the early stages of the 2020 COVID-19 Pandemic, the Principality Stadium in Wales, like similar venues across the country, was turned into a large field hospital. The urgent transformation of these vast public spaces into hospitals was carried out at large expense to the taxpayer and diverted time and resources away from more clinically important endeavours. In Cardiff, the plan was to, initially, create a 400-bed facility at the Rugby stadium with the option to increase this capacity tenfold. In the end, the number of patients treated at the stadium, was less than 40, with not one patient in the acute phase of their illness. At no point, during the pre-pandemic meetings that took place in Wales, that I attended, did we discuss the use of field hospitals.

We knew, from the findings coming out of Wuhan, that I conveyed to the Chief Medical Office in Wales and the CEO of PHW, . **(INQ000211741)** *(Email and documentation held on file)* that those who developed COVID-19 symptoms from their SARS-CoV-2 infection needed high dependency/ITU management and there were simply not enough skilled doctors and nurses, with ITU training, to staff a field hospital. The field hospitals were a symbolic gesture and a tilt to the past, particularly 1918, where all that could be offered to patients was hope and had no place in 21<sup>st</sup> century planning. The direction of travel on this, driven by the Westminster Government, was not, like many things, based on science and clinical need, more the need to be seen to be doing something.

Field hospitals did not figure large in any discussions, to which I was a party, in pandemic planning, to the contrary, the 2011 UK pandemic plan called for business as usual and to build on current resources, not build facilities that were neither suitable, or needed, which could never be staffed. If one were to create such behemoths, the sensible thing would have been to use them as step-down care facilities, where frail individuals could be rehabilitated back to health, rather than discharging untested patients from hospitals to care homes.

#### 8. Changing personnel and abstract planning

No truer example of the words, of Helmuth von Moltke, "*No battle plan ever survives first contact with the enemy*", than in pandemic planning.

Pandemic planning, like planning a battle, is often carried out in the abstract and without full knowledge of how events will unfold. The consequence of these abstract planning processes, often iterated over long periods of time, is that personnel change and the plans themselves become distant, in time and space, both from the frontline and the generals who have to implement them. This is undoubtedly true for the planning that was carried out

during the 2009 to 2020 period, a period when the NHS and Social Care systems were under a continued assault from draconian cuts to budgets and services. Time had passed so that organisational, personal memories and experience of 2009 had faded. Many 'battle hardened' senior staff had left, or retired, or were left out in the cold of senior decision making within the Welsh Government, advice offered often being seen as interference. It is therefore no surprise that when the central planning machinery in Whitehall said jump the response from Cardiff was overwhelmingly and uncritically, 'How high?'

# 9. Future issues and questions that need to be addressed in planning for a future Pandemic

Going forward and looking towards future planning for a pandemic the following needs to be taken into account.

- A well-trained flexible Health and Social Care workforce needs to be built up, with resilience as the cornerstone of planning. To achieve this there needs to political will to actively train and recruit doctors and nurses to increase the pool of highly skilled professionals in primary and secondary care. This will involve a massive expansion and reforming of training and training places in this country. It also means the rules on ethical recruitment and immigration, to this country, will need to be reviewed in the short to medium term. In parallel to this, we need a total overhaul of the career structure and training of care workers to ensure this is an attractive, well paid endeavour, not try to deliver these vital services on a 'shoestring'.
- Coupled with the expansion in the NHS workforce there needs to be continued investment in secondary care, to build resilience and surge capacity into the system. During this process, the planning needs to take into account the flexibility in ward structures so that the bed estate can be segmented, as required, into ITU/HDU, convalescent beds, etc.
- Rather than building 'Nightingale hospitals' to cope for the acutely unwell, without staffing numbers to ever provide care, planning needs to seek out suitable venues that can be quickly switched to 'step-down' convalescent facilities, of lower acuity, that require carers, not intensivists, hence avoiding the danger of taking infection risk into care homes.

- It is unclear as to what, or where, the next pandemic virus will be, however, within our planning we must now take account that a pandemic caused by an Influenza A virus is likely to have a very different dynamic, in terms of age profile and our ability to mitigate, compared to one caused by a coronavirus. We need to take the potential demographic differences, of the potential causative agents, into account in our planning scenarios.
- The undoubted success of mRNA vaccines in managing the COVID-19 pandemic gives an incredible boost to the whole concept of treating viral disease and, therefore, the UK needs to invest heavily in this new pluripotent technology. It is clear that, on emergence and sequencing of a novel virus, a vaccine can be manufactured within a very short period of time. mRNA technology offers great potential to offer timely protection to a nation under threat but is only useful if the infrastructure for research, manufacture and distribution exists. Any future pandemic plan needs to embrace this and similar issues relating to the stockpiling of vaccines and antiviral therapies.
- The UK Government, during the early stages of the COVID-19 pandemic, put great store in the message of following the science, yet, most of its early policies were driven by untested mathematical models, as if they were predictions. What followed was that decision-making became dominated by mathematicians and others, such as physicists and policy makers/public health professionals, with little, or no, experience of infectious, let alone, pandemic disease, to the exclusion of those who might have an important input to make. Following the science became a mantra with little basis in action. For example;

a) discharge of untested patients back to care homes in the early stages of the pandemic, when it was clear that the evidence, in relation to coronavirus infections, pointed to asymptomatic carriage and extended viral excretion.

b) Closure of schools when the young were clearly at incredibly low risk of severe outcomes from infection and based on the premise that out of school the children would not meet with their friends.

c) Lockdown, face masks and social distancing of two metres, or more, are all areas that need thorough research and evaluation as it would appear that the balance sheet on benefit to harm ratio does not fall squarely on the benefit side and has resulted in a huge, undocumented level of collateral harm, mostly amongst individuals at low risk from SARS-CoV-2 infection itself.

d) The real risk of long distance viral transmission, via aerosol, has never been truly evaluated, over and above the theoretical. However, it is clear that the viral load, within a single aerosol particle, is inversely related to its volume, as is, its ability to remain airborne and hence have the potential for inhalation. All of which means that some of the fanciful models, developed by some mechanical engineers, about the potential dangers of long distance infections, caused by aerosols, need to be fully evaluated, as this knowledge will dictate a sensible approach to keeping society running and safe in the future.

e) It is clear from the COVID-19 pandemic that achieving zero COVID-19, unless you happen to be New Zealand, is incredibly difficult to achieve. Much social disruption occurred within the UK, within Wales and between Scotland and other parts, based on the erroneous belief that a pandemic virus, such as SARS-CoV-2, which was highly transmissible, with the majority of infections being asymptomatic, could be eliminated from a particular region by restricting travel. It is clear that this is only partly achievable with, total, indefinite, lockdown, in the majority of cases the disruption to normal life is not worth the small gain. Cf., the rapid spread of Omicron and other variants from their place of origin, across the world, despite draconian travel bans. The high death rate in China, in late 2022, due to COVID-19, was a sobering reminder that in unprotected populations, created by draconian lockdowns, the SARS-CoV-2 virus is still lethal. This is another area for future research and evaluation.

The above is just a flavour of some of the areas of scientific endeavour which need to be explored as we move forward with planning for a future pandemic.

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