

COVID-19: An update from England's high consequence infectious diseases intensive care unit leads

Daniel Martin¹ , Sarah Platt², Peter Hampshire³ and Chris Meadows⁴

Each winter, the population and healthcare services around the globe brace themselves for what is usually a fairly unpredictable bombardment by a myriad of microbial pathogens. From an immunological perspective, human hosts are constantly modifying our defences, aiming to reduce the potential impact of this invisible force. We can bolster the fight by using annual vaccinations against influenza but by definition, we must already have an intimate knowledge of our enemy to generate this additional immunological shield. Sadly, newcomers on the microbial scene tend to slip straight through net and hit us hard. Hence, the effectiveness of the seasonal flu vaccination waxes and wanes annually, as new (and previously unseen) strains of the flu virus appear.¹ Despite not reaching the threshold to be classified as 'living organisms,' viruses may ultimately be our downfall; leaping from species to species and mutating at alarming rates, it is a wonder that we manage to keep up with them at all. The current global pandemic has been caused by a novel coronavirus, referred to as 'severe acute respiratory syndrome coronavirus 2' (SARS-CoV-2), which leads to coronavirus disease 2019 (COVID-19). Likely originating from another species (possibly a bat), this virus spreads via respiratory droplets, with droplets on surfaces potentially posing the greatest transmission threat. The magnitude of the spread of this disease is such that reports are outdated almost as soon as they are published. As you read this article, the pandemic is likely to have reached a state unimaginable when this article was drafted only a week ago.

But this pandemic was predicted. In 2019, the Global Preparedness Monitoring Board produced their *first annual report on global preparedness for health emergencies*.² This collaborative of world leaders and experts, co-convened by the World Bank Group and the World Health Organization in the wake of the 2014–2016 Ebola epidemic, set out to identify critical gaps in preparedness for a variety of global scenarios. Their first report, so perhaps their highest priority scenario, explored biological risks manifesting as epidemics and pandemics. Reading through it shortly after it was published, it felt like the script of a Hollywood disaster movie, but now it is an incredibly sobering prediction

of what we are living through today. The authors did not hold back with their predictions: '*There is a very real threat of a rapidly moving, highly lethal pandemic of a respiratory pathogen killing 50 to 80 million people and wiping out nearly 5% of the world's economy.*' All we can do is to hope that COVID-19 will not be this 'Disease X' but a wakeup call that makes everyone on Earth rethink how we are going to live alongside microbes which threaten the structure of modern society.

A high consequence infectious disease (HCID) is defined as an acute infectious disease with a high case-fatality rate that has little in the way of effective prophylaxis or treatment. They are usually challenging to differentiate from other common infectious diseases so go undetected and spread rapidly through communities and, more worryingly, healthcare systems. The devastating results of a single patient presenting to a hospital in South Korea with Middle East Respiratory Syndrome coronavirus infection is a chilling tale of how an undiagnosed HCID can wreak havoc in a very short space of time.³ The Ebola outbreak of 2014–2016 triggered NHS England to think about a more robust approach to dealing with HClDs, and the HCID network was formed in England. Dividing HClDs into contact (primarily the viral haemorrhagic fevers) and airborne (respiratory droplet or aerosol transmission) (Table 1), hospitals were commissioned to be designated tertiary referral centres for patients with a positive diagnosis of an HCID. Resources were allocated to prepare these centres to safely manage infected patients.

¹University College London Intensive Care Unit, Royal Free Hospital, London, UK

²Royal Victoria Infirmary, Newcastle upon Tyne, UK

³Royal Liverpool Hospital, Liverpool University Hospitals NHS Foundation Trust, Liverpool, UK

⁴Guy's & St Thomas' NHS Foundation Trust, London, UK

All authors are Intensive Care High Consequence Infectious Diseases Leads.

Corresponding author:

Daniel Martin, University College London Intensive Care Unit, Royal Free Hospital London, UK.

Email: dsm.jics@gmail.com

Table 1. A list of contact and airborne high consequence infectious diseases as agreed by Public Health England (PHE) and the NHS England HCID programme.

Contact HCID	Airborne HCID
Argentine haemorrhagic fever (Junin virus)	Andes virus infection (hantavirus)
Bolivian haemorrhagic fever (Machupo virus)	Avian influenza A H7N9 and H5N1
Crimean Congo haemorrhagic fever (CCHF)	Avian influenza A H5N6 and H7N7
Ebola virus disease (EVD)	Middle East respiratory syndrome (MERS)
Lassa fever	Monkeypox
Lujo virus disease	Nipah virus infection
Marburg virus disease (MVD)	Pneumonic plague (<i>Yersinia pestis</i>)
Severe fever with thrombocytopenia syndrome (SFTS)	Severe acute respiratory syndrome (SARS)
	Coronavirus disease (COVID-19)

Adapted from: <https://www.gov.uk/guidance/high-consequence-infectious-diseases-hcid>.

Table 2. High consequence infectious diseases centres in England.

Contact HCID treatment centres in England
Royal Free London
Newcastle Royal Victoria Infirmary
Airborne HCID treatment centres in England
Guy's and St Thomas' NHS Foundation Trust (adult and paediatric services)
Royal Free London NHS Foundation Trust, with a paediatric service provided by Imperial College Healthcare NHS Foundation Trust
Royal Liverpool and Broadgreen University Hospitals NHS Trust, with a paediatric service provided by Alder Hey Children's NHS Foundation Trust
Newcastle upon Tyne Hospitals NHS Foundation Trust (adult and paediatric services)

Adapted from: <https://www.gov.uk/guidance/high-consequence-infectious-diseases-hcid>.

A multidisciplinary approach was taken to provide a comprehensive team at each centre, led by those who would be called on to deliver that care: specialists in infectious diseases and intensive care medicine. The role of intensive care medicine in HCIDs is crucial, as was seen in the Ebola outbreak⁴ and current COVID-19 pandemic.^{5,6} Each of the HCID centres (Table 2) has an intensive care lead, whose role is to coordinate preparedness locally and link the intensive care units (ICUs) ensuring a flow of information and learning. The HCID ICUs are constantly ready to activate their plans and accept referrals from across England.

'The best laid plans...' Before the HCID network there was little in the way of a coordinated national plan to deal with HCIDs, particularly in terms of capacity and joined up thinking. Its creation brought together geographically separated centres to share ideas and approaches. It was ready for action. But how do four hospitals, in the middle of the annual winter bed crisis, deal with a global airborne pandemic? The short answer is, they don't. Plan B has already been initiated, which is that every ICU in the country readies itself, in a matter of days, to be an airborne HCID centre. The scale

of what we have witnessed in China and Italy has left all of us with a lingering sense of dread. The question of whether this is about to happen in the UK and, if so, how bad it is going to be will likely have been answered by the time this goes to print. In this brief calm before the storm, everyone needs to ready themselves for the inevitable. The task is unthinkable though.

The current task was perhaps previously unthinkable: to train up every frontline member of staff in the use of personal protective equipment (PPE); and to draw up detailed plans to and to draw up detailed plans to cover scenarios ranging from one COVID-19 positive patient on ICU, to every mechanical ventilator in the building being used to ventilate COVID-19 with severe hypoxia. Where does one even start with such a task?

Top-down leadership and guidance in parallel with bottom-up dissemination of expertise and experience is essential in this preparatory phase, in order to get things right. We require clear messaging from those with a national view of the situation, filtered down through Royal Colleges, Faculties, Societies, specialities, Trusts and departments. We must avoid the natural instinct to all run in opposite directions when disaster strikes, producing conflicting guidance and messaging. We need to banish all thoughts of the second law of thermodynamics and prevent an increase in entropy. Calmness and a rational approach to dealing with this crisis will ultimately be our strength, as opposed to each and every hospital in the country raising the drawbridge and fighting it alone in their own unique way. Such talk is easy, but what are we actually going to do? As intensivists at HCID centres we have been at an unfair advantage, having readied ourselves for this long ago. That said, we were ready to admit one or two patients at each centre, isolate them and manage them safely, but this state of readiness never extended to the scenario of a pandemic. So, whilst we had a head-start, the playing field is rapidly being levelled. Our role now is to share what experience and expertise we have in the management of airborne HCID patients (be that suspected or confirmed) in order to turn every ICU in the country

into an airborne HCID centre. Data now being published from Italy confirm that ICUs will play a central role in this pandemic, so as a specialty it is time for us to step up and deliver everything we have to see us through this.⁷

Converting your already busy ICU into an HCID-ready environment and ensuring the preparedness of your staff will not be easy. The task is made more difficult by the rapidly changing landscape of this pandemic and the framework in which the country is dealing with it. Guidance is updated almost daily and we must respond to this as best we can. In times like this one cannot expect to be handed a standard operating procedure that can be followed to the letter to complete the task. As we learn more about this disease and move through different stages of contagion in the community, the plans must be rapidly reassessed and adapted to achieve success. Think of the system like the Cabinet War Rooms, seeking up-to-date intelligence on a complex battle being fought on multiple fronts. Those at the front line are desperate to know the overall game plan yet, at the same time, how to capture the hill right in front of them. This represents a near impossible juggling act of disseminating enough information to keep those at the sharp end in the loop, but not overwhelming them with the plans for the final assault. In this analogy it is the Generals who maintain the two-way flow of information and ultimately win the war. Our Generals in this pandemic must therefore be ready for what we are about to face.

Guidance from various bodies is now hitting our screens daily, combining the knowledge and experience of a wide variety of individuals, to guide the country through this difficult time. Little of what can be produced for this purpose fits our usual rigorous evidence-based approach. It has to be formulated from what little evidence there is available, the experiences endured by our colleagues abroad who are already faced with overwhelming numbers of patients, and a healthy dose of common sense. It is important that we begin to understand that this guidance is likely to change over time, so we need to pay attention to what is going on around as well as providing care to patients under exceptionally difficult circumstances. Rather than replicating guidance already being produced, we would advise you to keep a watchful eye on the following websites:

- A working collaboration formed by The Faculty of Intensive Care Medicine, Intensive Care Society, Association of Anaesthetists and Royal College of Anaesthetists: <https://icmanaesthesiacovid-19.org>
- Emergency Preparedness, Resilience and Response (EPRR): <https://www.england.nhs.uk/coronavirus/>

The National Emergency Committee for Critical Care has now been formed in the UK to bring together disparate strands of work into one framework for the UK. However, one of the most important things we

should all read is the Intensive Care Society wellbeing resource library: <https://www.ics.ac.uk/ICS/Education/Wellbeing/ICS/Wellbeing.aspx?hkey=92348f51-a875-4d87-8ae4-245707878a5c>. What we are about to face is unthinkable and will take a toll on us all. Our psychological wellbeing is paramount. We spend a great deal of time learning how to don and doff PPE in order to remain physically well, yet virtually no time considering how to cope with the experiences we will all endure. Please use the resources on this superb website, print out the posters, pin them up and emphasise the importance of looking out for each other's welfare.

This is intensive care's time to show the country that we are ready and able to face the challenge ahead of us. Good luck and stay safe.

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

ORCID iD

Daniel Martin  <https://orcid.org/0000-0001-6220-8235>

References

1. Dawood FS, Chung JR, Kim SS, et al. Interim estimates of 2019–20 seasonal influenza vaccine effectiveness – United States, February 2020. *MMWR Morb Mortal Wkly Rep* 2020; 69: 177–182.
2. Global Preparedness Monitoring Board. A world at risk. Annual report on global preparedness for health emergencies, 2019, https://apps.who.int/gpmb/assets/annual_report/GPMB_annualreport_2019.pdf (accessed 24 March 2020).
3. Cho SY, Kang JM, Ha YE, et al. MERS-CoV outbreak following a single patient exposure in an emergency room in South Korea: an epidemiological outbreak study. *Lancet* 2016; 388: 994–1001.
4. Uyeki TM, Mehta AK, Davey RT, et al. Clinical management of Ebola virus disease in the United States and Europe. *N Engl J Med* 2016; 374: 636–646.
5. Wang D, Hu B, Hu C, et al. Clinical characteristics of 138 hospitalized patients with 2019 novel coronavirus-infected pneumonia in Wuhan, China. *JAMA*. doi: 10.1001/jama.2020.1585. [Epub ahead of print] [accessed 7 Feb 2020].
6. Yang X, Yu Y, Xu J, et al. Clinical course and outcomes of critically ill patients with SARS-CoV-2 pneumonia in Wuhan, China: a single-centered, retrospective, observational study. *Lancet Respir Med*. pii: S2213-2600(20)30079-5. doi: 10.1016/S2213-2600(20)30079-5. [Epub ahead of print] [accessed Feb 24 2020].
7. Grasselli G, Pesenti A and Cecconi M. Critical care utilization for the COVID-19 outbreak in Lombardy, Italy: early experience and forecast during an emergency response. *JAMA*. doi: 10.1001/jama.2020.4031. [Epub ahead of print] [accessed 13 Mar 2020].