Expert Report for the UK Covid-19 Public Inquiry

Module 3: The impact of the Covid-19 pandemic on healthcare systems in the UK

Intensive care: the last line of defence

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Author statement:

We confirm that this is our work and that the facts stated in the report are within our knowledge. We understand our duty to provide independent evidence and have complied with that duty. We confirm that we have made clear which facts and matters referred to in this report are within our knowledge and which are not. Those that are within our own knowledge we confirm to be true. Our opinions represent our accurate and complete professional opinions on the matters to which they refer.

July 2024

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Conflicts of interest statements

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Professor Charlotte Summers is Professor of Intensive Care Medicine and Director of the Victor Phillip Dahdaleh Heart & Lung Research Institute at the University of Cambridge. In addition to her university academic work, she spends 50% of her time undertaking NHS clinical practice as an Honorary Consultant in Intensive Care Medicine for Cambridge University Hospitals NHS Foundation Trust. Prof Summers is a Fellow and Director of Studies in Clinical Medicine at Selwyn College, Cambridge.

In February 2020, Charlotte returned to full-time NHS clinical service for nearly 14 months (leading the Addenbrooke's Hospital Critical Care Response for the pandemic) before returning to her usual work pattern (as above). Alongside her clinical work, during the pandemic, she undertook the following additional potentially relevant voluntary roles from which she derived no financial benefit:

- Clinical advisor to the Cabinet Office/DHSC Ventilator Challenge programme
- Member of the UK-Covid Therapeutic Advisory Panel (UK-CTAP)
- Council Member of the Intensive Care Society (2020-2022) and Chair of the "Intensive Care 2020 and Beyond" multi-stakeholder report regarding the future of intensive care in the UK
- Co-author of multiple clinical management guidelines issued jointly by the Intensive Care Society, Royal College of Anaesthetists, Faculty of Intensive Care Medicine, and Association of Anaesthetists
- Member of the Wellcome Trust Therapeutic Accelerator for Middle Income and Developing Nations Prioritisation Panel
- Participated in NHS England Therapeutics and Access Policy Group meetings
- Co-authored the Academy of Medical Sciences "Challenging Winter 2021-22" report and the update for winter 2022-23
- Provided comments on multiple draft NICE guidance documents relating to drug therapies for Covid-19
- Chief Investigator of HEAL-COVID, an NIHR-funded Urgent Public Health national clinical trial seeking treatments to improve the longer-term outcomes in people hospitalised with Covid-19, and was a co-investigator for the GenOMICC and ISARIC4C observational clinical studies
- Participant in the NHS England peer support visits to NHS hospitals in England during 2021 referenced in this report.

Dr Ganesh Suntharalingam OBE BA (Cantab) MB BChir FRCA FFICM

Dr Ganesh Suntharalingam is a full-time active-duty ICU consultant at London North West University Healthcare Trust. Listed below are his potentially relevant roles alongside his clinical work. All posts are on a voluntary, unremunerated, and either elected or appointed basis.

- 2018 (Dec) – 2020 (Dec) President and Chair of Board of Trustees, Intensive Care Society (Charity No. 1039236, Charity Commission). Leadership of national voluntary professional and scientific body, including collaboration with multiple other national bodies and the NHS.
- 2020 Participant, DHSC national guidance group: "Clinical prioritisation and risk thresholds", by invitation. Details of this work are given in this report.
- 2020 Co-Chair, National Emergency Critical Care Committee. Multi-agency voluntary forum for key collaborations, hosted by, but distinct from, the Intensive Care Society.
- 2020 Deputy Chair, National Post Intensive Care Rehabilitation Collaborative. Multi-professional and interdisciplinary collaboration addressing post-COVID-19 recovery of critically ill patients.
- Co-author and/or signatory of various published Intensive Care Society statements and guidelines.
- Co-editor and co-signatory of the joint Faculty of Intensive Care Medicine, Intensive Care Society, Association of Anaesthetists, and Royal College of Anaesthetists Covid-19 information and guideline hub, 2020-21.
- Honorary Chair, North West London Critical Care Network.
- No formal (appointed/remunerated) NHS England (NHSE) or equivalent role. Co-opted participant in some NHSE critical care meetings in the capacity of Intensive Care Society President (professional Society/charitable). Attendance depended on availability and competing clinical, local and national (charitable) leadership pressures under pandemic conditions.

Prologue

The Unsung

I will not clap for you – forgotten, tethered, unsung.
Piecing together the story from a look on their face, the blood.
Moments so pernicious, so painful.
"I always wanted to help people" echoes past the flickering lights
and cold coffee as you roll up your sleeves knowing
someone's mother, brother, neighbour waits.

I cannot clap for you – wayfinders. Suturing hope in shifts
from behind a curtain, a pane of glass.
Slides of sliced skin, their vibrant colour-answers
hide in clouds and ink blots. Yet you navigate to a person.
Entering homes frothing with fear, you leave behind
something shaped like a warm embrace.

I dare not clap for you – shamans glowing in the shade.
Seeking glimmers of hope, holding plasma up to the light.
How do you conjure smiles and successes
without any sleep or certainty? Nurturing faith from crumbling chaos.
Patients unaware of your service
mouthing prayer-like, 'troponin' or 'palliative'.

Take this pen, my paper, these words.
But I promise you no applause,
For applause implies the work has ended.

Written by Hanan Issa, National Poet of Wales, to mark the 75th anniversary of the National Health Service. Literature Wales commissioned the poem and its translation into Welsh by Grug Muse.

(The poem was intended to mark those, such as in GP surgeries and laboratories, with a less public profile than those in intensive care: we cite it here not only to honour them and their roles but also as we feel it will resonate with everyone in health and care, especially in its closing lines).

Available, including in Welsh, at: https://cardiffandvale.art/the-unsung/

Executive summary

i. In 2020, Covid-19 was a novel, life-threatening disease with an unknown potential to grow in prevalence, severity, and impact on the health and lifespan of the UK population. During the pandemic, rapid progress was made in understanding the disease, finding new therapies, and rolling out improvements in supportive care. The UK played a leading part in the global research effort, underpinned by more than a decade of investment in research infrastructure via the National Institute for Health and Care Research and others; our unified healthcare system; widespread clinical trial recruitment and pathogen sequencing; prompt dissemination of learning; rapid integration of new knowledge into clinical guidance; and successful efforts to ensure uniform availability of relevant drugs across all four nations as each recommendation was made. The parallel and equally remarkable progress in vaccine development is outside the scope of this report but should also be commended.

ii. Covid-19 clinical research that changed the trajectory of the pandemic took place due to new programmes being rapidly set up from early 2020 onwards and via the repurposing and activation of existing research platforms. The infrastructure and organisational foresight that enabled success must be recognised, rebuilt where necessary, and provided with sustainable support and funding as a core component of the UK's national security defences.

iii. Access to adequately resourced, high-quality critical care underpins the ability of any healthcare system to deliver emergency and planned care, both in 'peacetime' and during extreme contingencies such as a pandemic. The severe, multi-organ impact of Covid-19 on the human body and the need for intensive care provision threw a spotlight on all aspects of our care of the critically ill. Firstly, it highlighted the importance of having sufficient ICU capacity and enough suitably skilled people to provide lifesaving care to all who need it, with enough 'headroom' to do so safely during usual and foreseeable fluctuations in demand. Secondly, the crisis conditions of the pandemic raised important questions about how far such specialist expertise and facilities can be stretched and diluted before their effectiveness becomes degraded and what is being delivered is no longer meaningful critical care. Thirdly, we are only beginning to understand the long-term impact on staff and on the recovery of a functioning healthcare system in the aftermath of an event such as a pandemic. Our report touches on these aspects.

iv. Intensive care unit (ICU) capacity and the risk that it might become overwhelmed were core considerations in strategic decision-making during the pandemic. The UK entered the pandemic with less ICU capacity (in other words, fewer staffed, equipped ICU beds) than other developed economies and healthcare systems. Combined with a relatively high number of infections in the initial waves, this meant that the UK had further to stretch in response to Covid-19 demand. The concept of ICU capacity was poorly understood by many and lacking in baseline data. Appropriately and necessarily, there was an early focus on expanding physical spaces, piped gas (oxygen), power and other infrastructure, including equipment. However, we believe there was insufficient early emphasis on the complexities of the underlying system or the human limits of staff. As a result, it is likely that functional healthcare system capacity was

over-estimated, albeit with rapid learning between the first and second waves about the need to decompress individual units and minimise local over-stretch.

v. The vocabulary and communication related to critical care capacity varied between UK nations, with Scotland, Wales, and Northern Ireland discussing ICU bed occupancy as a ratio of pre-pandemic baseline, and England instead referring to bed occupancy as a fraction of theoretical maximum newly expanded capacity. This is important, especially given the outsized contribution of English ICU bed capacity to the national total, as - although done with good intent for tracking the likelihood of ICU capacity exhaustion - it led in practice to a widespread lack of public, political and media understanding of how stretched the system became, particularly in the hardest-hit areas and at the peak of pandemic waves when ICU staff dilution was at its maximum.

vi. The fast-moving nature of the pandemic meant that the mainstay of service delivery under crisis conditions was through real-time, frontline adaptations to meet local demands, demographics and epidemiology. These were carried out with central support and guidance but starting from a baseline below that of comparable G7 nations. It took supreme effort, innovation, and flexible working to close the gap between supply and demand. It is difficult for the public to have insight into the challenges of doubling or tripling the activity of a small, medium or large ICU, even from 10 beds to 30. The nearest analogy might be tripling the size and activity of the local fire station with borrowed vehicles and staff or converting Heathrow into a military airfield with double or triple the number of flights a day. These sometimes massive, geographically varied surges in capacity came at the cost of harm to staff physical and mental well-being, moral injury (psychological damage to professional staff that comes from having to deliver care in ways that fall short of their own values and expectations), and the potential for unintended variation in decision-making under pressure. Together, these have had a severe and lasting impact on the post-pandemic operational capability of the NHS and, hence, the long-term health of the people it cares for.

vii. The profound impact of the pandemic on patients requiring intensive care and those close to them must be acknowledged. Patients were necessarily looked after in ways that were stretched and diluted compared to usual critical care, sometimes in makeshift ICUs, sometimes very far from home, and for much of the time with no or limited access to their families and others close to them. The cost of being unable to be at the bedside of a loved one during severe illness or (especially) those dying, will have been a heavy one. As NHS staff, our primary purpose is patient care, and the combined effect of the pandemic on a background of chronic under-resourcing of staffed ICU beds meant that we could not always deliver the care we would have wanted to.

viii. As the pandemic progressed, the harmful effects of stretched working and the upper limits of diluted staffing ratios were increasingly recognised. This was paralleled by the further development of critical care transfer networks and teams that enabled more systematic decompression and load-balancing between hospitals and areas. This 'mutual aid' facilitated the transfer of critically ill COVID patients from an ICU that had exceeded its capacity to

continue safe patient care to another ICU at a lower capacity. Mutual aid transfers occurred either within a regional area or across regions during the pandemic peaks. The permanent establishment of fully funded critical care transfer systems in many - but not yet all - parts of the UK remains a positive outcome of this pandemic.

ix. The pandemic response highlighted the need for greater public awareness of what intensive care entails and what it means for patients and their loved ones. In the report, we discuss advance care planning and how best to ensure that people are treated in accordance with their wishes and values when their health deteriorates. An important lesson reinforced by the pandemic is that discussions regarding an individual's wishes are best undertaken while people are in their best state of health and have autonomy, complete information, and plenty of time for careful, respectful conversations rather than in haste under emergency conditions such as during a sudden illness or deterioration. This is important in individual decision-making in ordinary life and healthcare, as much as it is during a public health emergency. The pandemic has reinforced that emergency conditions often arise before people expect and that there is a need for better understanding, and a society-wide discussion, of the benefits and limits of high-technology care and how it aligns with people's values and preferences, whether in the event of an unforeseen life-threatening illness or at the natural end of life

x. It is essential to recognise that the response of the healthcare systems within the UK to Covid-19 was fundamentally reactive rather than proactive and that this reflects underlying structural deficiencies in intensive care provision (infrastructure and specialist staff) across the UK. It is critical, both for the future of everyday acute healthcare in the UK and for future contingency planning, that these deficiencies are studied and rectified so that lifesaving critical care resources become better matched to patient needs across the UK.

xi. Research was the critical activity that allowed us to understand the SARS-CoV-2 virus, and to develop diagnostics, vaccines and therapies. Without large-scale, sustainably resourced research capacity across the NHS, academic, and broader life sciences sector, we would not have been able to change the trajectory of the pandemic in any meaningful way. The UK's vibrant academic and commercial life sciences ecosystem and many years of investment by various research funders allowed us to deliver what was required. Much has been learned about how to tackle pandemic threats, and it is vital that this capability and capacity is not lost before the next outbreak arrives.

xii. Finally, we must ensure that the overly simplistic message "we coped" does not become the prevailing headline or a reason for complacency in future planning. We coped, but only just. We coped, but only at the expense of degrading NHS staffing and capability. We would have failed if the pandemic had doubled for even one more week, or if a higher proportion of the NHS workforce had fallen sick. Through the prism of critical care, it is crucial to understand how very close we came to a catastrophic failure of the healthcare system.

"It has been a damned [uncertain] thing — the nearest-run thing you ever saw in your life."

Arthur Wellesley, the 1st Duke of Wellington, after the Battle of Waterloo.

Effects of and treatment for Covid-19

How Covid-19 affects the body's systems.

1. Infection with the SARS-CoV-2 virus is recognised to have several potential outcomes – asymptomatic infection, mild illness not requiring medical attention, severe illness requiring hospital admission, and critical illness requiring advanced organ support and admission to intensive care (ICU). The symptomatic manifestations of SARS-CoV-2 infection are termed Covid-19. Covid-19 is a multi-system disease with both acute and longer-term consequences.

2. In the acute phase of critical illness arising from SARS-CoV-2 infection, derangements in the functioning of almost all organs of the body have been reported. Common presentations include:

    2.1 acute hypoxaemic respiratory failure (an inability to oxygenate the blood adequately, and hence the organs and tissues of the body) due to inflammation of the lungs (pneumonitis or pneumonia),

    2.2 pulmonary emboli (blood clots within the blood vessels of the lungs), or spontaneous pneumothorax (collapse of a lung);

    2.3 altered neurological status arising from infection, infarction (ischaemic stroke) or bleeding in the brain;

    2.4 acute kidney injury;

    2.5 cardiovascular compromise as a result of conditions including myocardial infarction ('heart attack'), sepsis or thromboembolism (blood clots forming within the circulation).

3. Depending on the degree of compromise of the various organ functions, advanced (artificial) organ support may be required as part of admission to the ICU. Despite often experiencing profound respiratory failure, Covid-19 causes a profound inflammatory response by the host immune system resulting in many critically ill patients with Covid-19 dying from multiorgan failure rather than as a direct consequence of the lung failure.

4. It became clear in 2020 that Covid-19 is associated with longer-term health consequences for some individuals, including those who have experienced a relatively mild initial acute illness. We recognise that post-acute Covid syndromes arise after the full spectrum of acute Covid-19 illnesses, but given the focus of our report, we have restricted our subsequent commentary to data relating to individuals hospitalised and/or admitted to ICU during their acute illness.

5. In addition to experiencing some of the >200 persistent Covid-19-related symptoms that have been reported [Davis HE et al, 2021], analysis of routinely collected health data from

people hospitalised in the first wave of the Covid-19 pandemic in England has shown that 29.6% of people hospitalised with Covid-19 acquired a new respiratory diagnosis in the post-acute phase of the illness, 4.8% a new major cardiac diagnosis, and 4.9% a new diagnosis of diabetes [Ayoubkhani D et al 2021]. The same analysis reported that 12% of people hospitalised during the acute phase of their illness died, and 29% were re-admitted to hospital, within ~6 months of hospital discharge – representing an increased risk of death and rehospitalisation for people experiencing severe or critical Covid-19. The current thinking regarding the longer-term consequences of Covid-19 has been recently summarised [Davis HE et al 2023] and is addressed in this Inquiry's expert reports on Long Covid.

Covid-19 and pregnancy

6. Specific concerns were raised around the impact of Covid-19 on people who were pregnant. Data from ICNARC, which collates data regarding almost all patients admitted to ICUs across England, Wales and Northern Ireland, show that a total of 964 people were admitted to ICU for Covid in the context of pregnancy or recent pregnancy between 01 March 2020 and 30 June 2022. A broad definition of pregnancy/recent pregnancy was used that includes ectopic pregnancy, molar pregnancy, and other major complications of pregnancy. The number of people admitted to ICU with pregnancy-related conditions during the pandemic was broadly in line with the numbers observed before the pandemic (i.e. there did not appear to be an overall increase in the context of Covid).

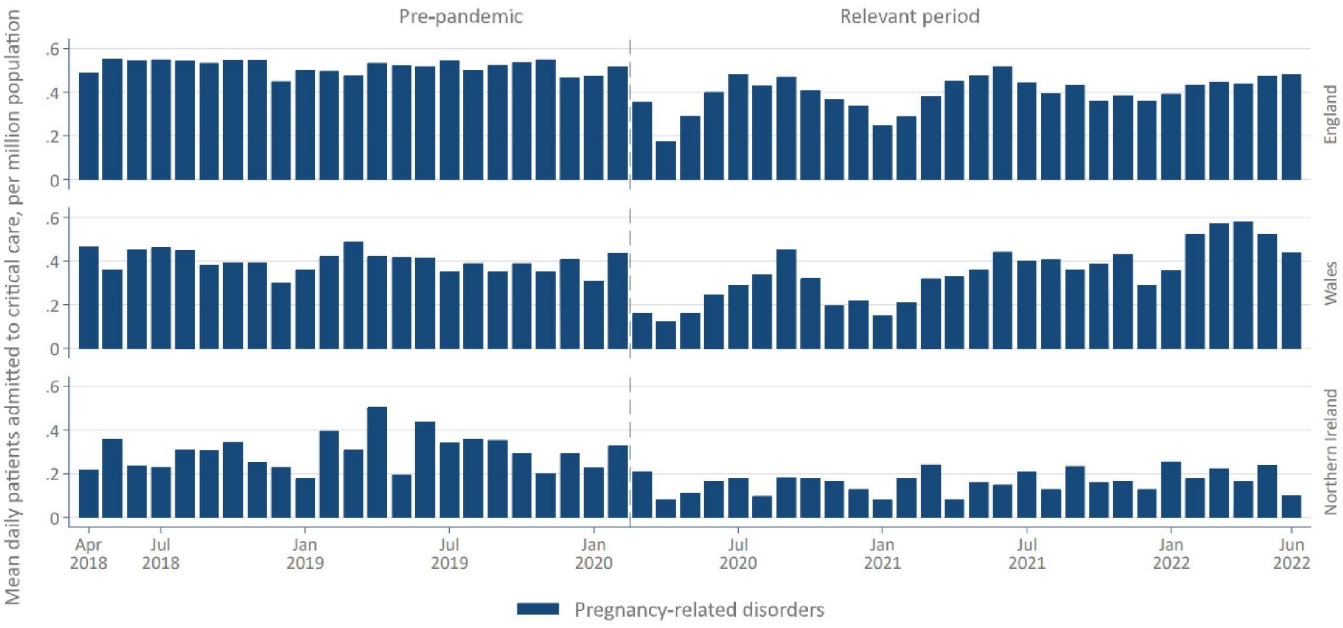

Figure 1: Mean daily patients admitted to critical care with pregnancy-related disorders per million population, by nation and month [ICNARC 2024b, INQ000480138, pg 34]

7. Of the people admitted to the ICU for Covid in the context of pregnancy or recent pregnancy in England, Wales and Northern Ireland, 6.9% died during their ICU stay, 9.3% died within 28 days, and overall hospital mortality was 10.4%. These data were broadly similar to those seen in the pre-pandemic period, except that overall hospital mortality in Northern Ireland was 9.9% before the pandemic and rose to 16.1% during the pandemic period.

8. In Scotland, 77 patients who were pregnant or recently pregnant were admitted to ICU for Covid-19. A single patient admitted to ICU with Covid-19 in the context of pregnancy died [SICSAG 2024, INQ000479816 pg 33].

Treatment for Covid-19

Respiratory support

9. Patients who cannot adequately deliver oxygen from their lungs via the blood to the organs and tissues that require it to function are described as having respiratory failure. Various supportive interventions to improve the delivery of oxygen that are used in clinical practice include:

    - Low-flow (up to ~15 L per minute) oxygen is delivered by a simple face mask or nasal prongs.
    - High flow (up to 70 L per minute) oxygen systems.
    - Continuous positive airway pressure (CPAP) – oxygen and pressure are delivered via a tight-fitting mask (or hood) whilst the patient continues to breathe for themselves.
    - Non-invasive ventilation – oxygen and pressure are delivered via a tight-fitting mask, as for CPAP. However, when the patient initiates a breath for themselves, the machine provides an increased pressure to support breathing.
    - Invasive mechanical ventilation – a patient is sedated to allow placement of a tube through the vocal cords (intubation), and a mechanical ventilator supports the patient to breathe in and out. Often, in the early stages of severe illness, patients require sedation to the extent that the ventilator undertakes almost all the work of breathing. As things improve, the patient is gradually weaned from the support provided by the ventilator by reducing the pressures used and decreasing the level of sedation to allow more work of breathing to be undertaken by the patient.
    - Extracorporeal membrane oxygenation (ECMO) - ECMO is a heart-lung machine that can replace or support the work of the vital organs by taking the patient's blood, oxygenating it, removing carbon dioxide outside the body, and then rewarming and returning the blood to the circulation. It is a modified form of the cardiopulmonary bypass used during heart-lung operations. It was originally a means of continuing

this support post-operatively; hence, it is only provided in the specialist centres in cardiothoracic hospitals.

10. In the early stages of the Covid-19 pandemic, there was uncertainty regarding the best clinical management strategy for this emerging infection. There was a diversity of opinion within the ICU community regarding the merits, or otherwise, of early intubation and mechanical ventilation to minimise the potentially infectious respiratory droplets and aerosols generated when using non-invasive respiratory support techniques, as well as concern regarding data from non-Covid-19 settings that suggested prolonged non-invasive respiratory support may be associated with poorer clinical outcomes (e.g. mortality).

11. In April 2020, the RECOVERY-RS trial was launched to investigate the hypothesis that in adults with Covid-19, continuous positive airway pressure (CPAP) or high-flow nasal oxygen (HFNO) are more effective than standard care in reducing the rate of intubation and/or mortality. The trial subsequently recruited 1,273 participants from 48 hospitals and found that in patients with acute hypoxaemic respiratory failure due to Covid-19, an initial strategy of CPAP reduced the risk of subsequent need for invasive mechanical ventilation and mortality compared to conventional oxygen therapy. However, no benefit was observed with the use of HFNO. The results were first published in a pre-print in August 2021 [Perkins GD, 2021], followed by a peer-reviewed article in January 2022. [Perkins GD et al, 2022]. These results were, therefore, only available to inform improvements to treatment after the second wave had ended.

12. Care of mechanically ventilated adults with respiratory failure in the prone position or 'proning' (caring for patients whilst they are lying face down) had been shown to be of benefit before the emergence of Covid-19 [Guerin C, et al, 2013]. Proning was recommended in clinical practice guidelines for the management of patients with severe respiratory failure for several years before the emergence of Covid [Fan E et al., 2017] and was widely adopted for both invasively mechanically ventilated and non-ventilated patients with Covid-19 from 2020 onwards, before definitive evidence of benefit in all groups of patients in which it was used being available. A systematic review of clinical trials subsequently suggested that in patients with Covid-19 associated acute hypoxaemic respiratory failure, awake proning reduced the need for intubation [Li J, et al 2022].

Pharmacological treatments

13. The UK research response to Covid-19 was initiated early in 2020. The diagram below (Figure 2) highlights some of the key milestones, and Annexe 2 lists the major late-stage clinical trials enrolling patients with Covid-19 in the UK, along with the timing of the announcement of the results.

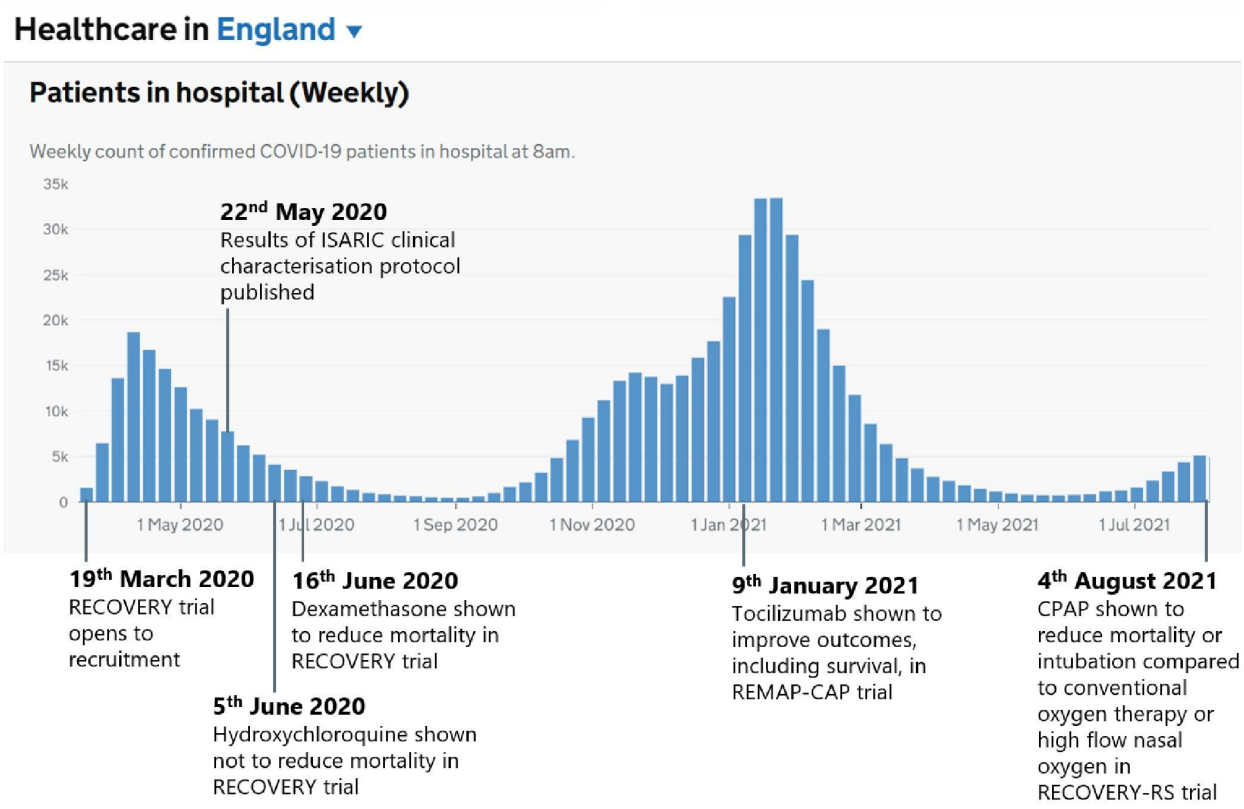

Figure 2: Early research milestones relevant to intensive care for patients with Covid-19. Background graph source: UKHSA Covid-19 dashboard for England, for illustrative purposes.

14. The RECOVERY trial opened to recruitment on 19 March 2020. Within ~100 days, it was discovered that hydroxychloroquine (widely proposed as effective at the time) and the antiviral therapy lopinavir-ritonavir were of no benefit but that dexamethasone reduced mortality in hospitalised patients receiving oxygen therapy, invasive and non-invasive respiratory support [The RECOVERY Collaborative Group, 2021]. The Chief Medical Officer for England and the UK government's Chief Medical Advisor, Prof Whitty, issued a Central Alerting System (CAS) message to all NHS Trusts in England, the CMOs in Northern Ireland, Scotland and Wales, independent healthcare providers, NHS Regional Offices, Regional Directors of Public Health, and many other organisations and individuals on 16 June 2020, disseminating the result and detailing the processes for the implementation of the discovery into clinical care with immediate effect [CAS Alert reference CEM/CMO/2020/026, INQ000283542].

15. On 2 September 2020, the REMAP-CAP international platform trial confirmed that hydrocortisone (a corticosteroid drug) reduced mortality in critically ill patients with Covid-19 [The Writing Committee for the REMAP-CAP Investigators, 2020]. A meta-analysis published on the same day statistically combined the results of multiple studies assessing various types of corticosteroids, finding an overall effect of a one-third reduction in the risk

of death in critically ill patients with Covid-19 [The WHO Rapid Evidence Appraisal for Covid-19 Therapies (REACT) Working Group, 2020].

16. Observational research examining the implementation of corticosteroids into clinical practice, including data from patients admitted to 237 acute general hospitals across England, Wales, Scotland and Northern Ireland, demonstrated that between June 2020 and April 2021, there was a rapid increase in the proportion of patients (who would have likely derived benefit) receiving corticosteroids from the date of the announcement of the RECOVERY trial data [Narni F et al., 2022]. The increase was similar across England, Wales, Scotland and Northern Ireland (see Appendix Figure S3 of the publication). In the week ending 14 June 2020 (immediately before the RECOVERY dexamethasone result was announced), 27.5% of hospitalised adult patients requiring supplemental oxygen received corticosteroid therapy. By the week ending 28 June 2020, this had risen to 50.3%, suggesting rapid uptake of the RECOVERY findings, and by mid-September 2020, more than 70% of people, who RECOVERY showed may benefit, received corticosteroid therapy. It must be remembered that it is unlikely the proportion of eligible patients who receive corticosteroid treatment identified in a retrospective analysis of real-world data will ever reach 100% as it is impossible to identify those for whom an appropriate clinical decision may have been taken that the risks (e.g. gastrointestinal bleeding, delirium, poor blood glucose control), for an individual patient may outweigh the benefit of the intervention.

17. NHS England (Prof Ramani Moonesinghe, NHSE/I National Clinical Lead for Perioperative and Critical Care), in collaboration with Intensive Care National Audit and Research Centre, undertook a process of care audit to understand how well evidence-based best practice had become embedded into routine clinical care. The ICNARC Case Mix Programme gathers data regarding almost all adult critical care admissions in England, Northern Ireland and Wales to benchmark clinical care. The process of care audit was embedded into the Case Mix Programme, and the care of >15,000 adults admitted to ICU between January 2021 and January 2022 was examined. Over this period, 93% of all adults admitted to ICU received corticosteroids during their hospital admission for Covid-19 (data kindly shared by Prof Moonesinghe).

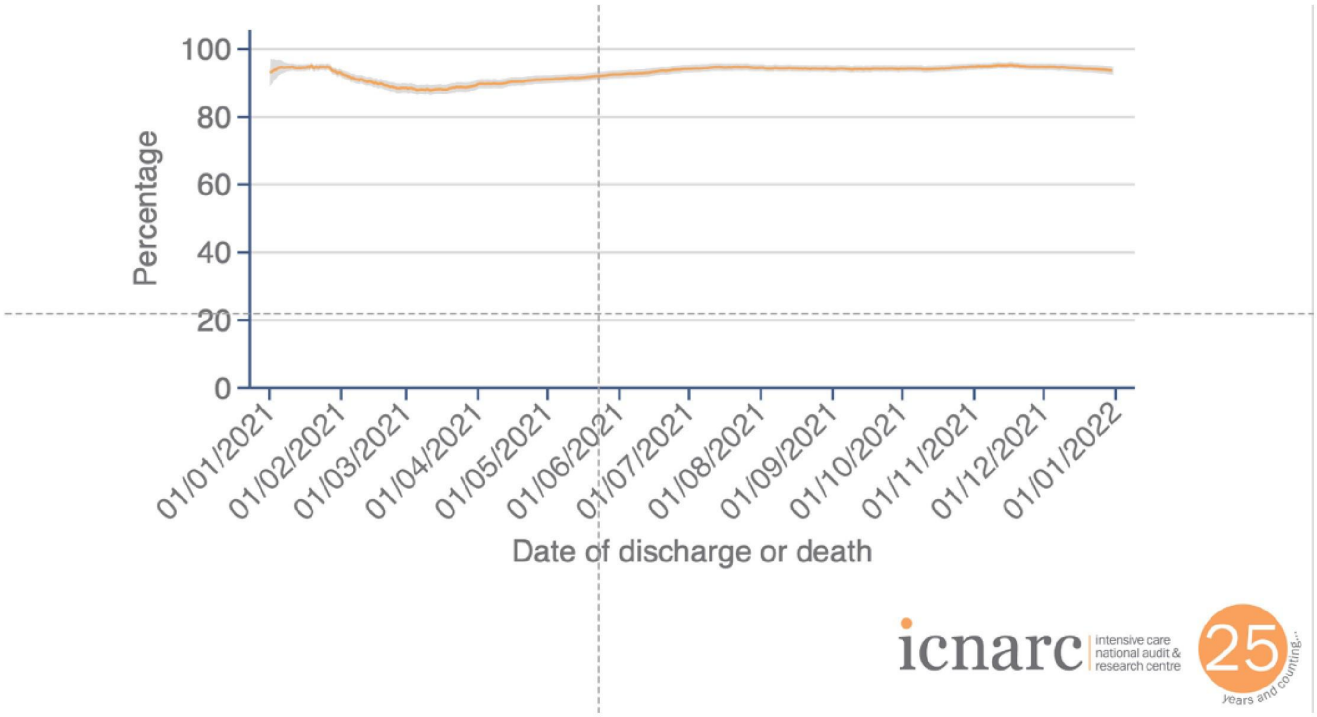

Figure 3: Percentage of adults admitted to ICU for Covid-19 who received corticosteroid therapy. The data are from the ICNARC Process Audit undertaken in April 2022 and include >15,000 patients across England, Wales and Northern Ireland.

18. On 07 January 2021, the REMAP-CAP trial posted a preprint reporting that interleukin-6 receptor antagonists, such as tocilizumab, improved outcomes, including survival, for critically ill patients with Covid-19 receiving organ support in ICU [The REMAP-CAP Investigators, 2021a], with the peer-reviewed paper published online on 25 February 2021 [The REMAP-CAP Investigators, 2021b]. The RECOVERY trial later confirmed this finding [The RECOVERY Collaborative Group, 2021]. As with dexamethasone, IL-6 receptor antagonists rapidly became the standard of care and were widely used, with the NHS working to ensure clinical supply and appropriate guidelines/advice were rapidly available across the NHS.

19. From relatively early Spring 2020, concerns were raised by clinicians and observational data that Covid-19 may be leading to an increased number of venous thromboembolic events (blood clots forming inside the blood vessels, which can cause illnesses such as strokes, deep vein thromboses, pulmonary embolism, etc.) [Nopp et al, 2020]. These reports led to a focus on whether we should be using increased anticoagulation (blood thinning treatment) as part of our care for people hospitalised due to Covid-19.

20. Usual care of adults admitted to intensive care units set out in 2018 by NICE guideline NG89 [National Institute for Health and Care Excellence, 2018] before the Covid pandemic recommended that everyone was assessed for the risk of venous thromboembolism and bleeding, and that prophylaxis against venous thromboembolism with low molecular weight

heparin (subcutaneous injections of blood anticoagulants) should be given to all those who did not have contraindications. Those in whom pharmacological prophylaxis was contraindicated should be considered for mechanical prophylaxis.

21. NICE guideline 191 made recommendations on 02 September 2021 that standard dose pharmacological prophylaxis with low molecular weight heparin should be offered to all young people and adults hospitalised due to Covid-19 who required supplemental oxygen, CPAP, NIV or invasive mechanical ventilation as soon as possible after admission. The guideline stated that prophylaxis should continue for a minimum of seven days, even if discharged from the hospital. Further, treatment dose (higher dose than prophylaxis) anticoagulation should be considered in people who require low-flow supplemental oxygen and do not have an increased bleeding risk, which should be continued for 14 days or until hospital discharge, whichever was sooner. These recommendations were made considering published data from the REMAP-CAP trial that showed that treatment dose anticoagulation improved the number of days hospitalised (but not critically ill) adults were alive and not in need of cardiovascular or respiratory organ support over the first 21 days after randomisation into the trial. REMAP-CAP showed that treatment dose anticoagulation was not beneficial for critically ill patients, so only prophylaxis was recommended in that setting.

22. The different recommendations for hospitalised non-critically ill adults and critically ill adults led to the question of what treatment a patient initially admitted to a ward who was later transferred to a critical care unit should receive. Again, the REMAP-CAP trial provided evidence to inform this [Bradbury et al. 2023], showing that treatment dose anticoagulation should be discontinued (reduced to a prophylactic dose) upon admission to critical care as treatment appeared harmful.

23. This illustrates the importance of rapid, high-quality research to test all treatments in clinically relevant subgroups (such as critically ill patients) where there is uncertainty about their effects in the setting of a new infectious disease. Supportive treatments or drugs designed to prevent complications may seem less obvious than, for instance, antivirals, but they are important to include in clinical trials for novel and emerging diseases.

24. However, in all cases (people with Covid-19 and without), in the event of a diagnosed venous thromboembolism (blood clot), in the absence of contraindications, treatment dose anticoagulation should be provided. This clinical management guidance was not altered for Covid-19.

25. Much effort was made by the NHS, particularly the Chief Medical Officers of the Four Nations, to minimise variation in the drug treatments received by patients with Covid-19 across the NHS and equivalents in the devolved nations. There will inevitably have been a degree of local variation in clinical management, but we are unaware of any robust data providing evidence that variation impacted clinical outcomes. Despite all good intent (and as people who were involved in the pressures of issuing national guidance, we were only

too aware), it is appropriate to acknowledge the vast challenges that rapidly changing guidance posed for frontline teams.

26. Multiple clinical management guidelines were issued during the Covid-19 pandemic by the NHS, NICE, professional societies, the World Health Organisation, and others. At times, the recommended clinical management differed between the various guidelines, and clinicians/hospitals needed to decide which they felt was most appropriate. Keeping abreast of the different guidance was challenging at a time when critical care units were under strain. The NHS took steps to consolidate and harmonise critical care guidance iteratively via an expert review group administered by NHS England and NHS Improvement [NHS England/Improvement 8 Apr 2020] as part of its 'Speciality guides for patient management during the coronavirus pandemic' series. As a clinical reference, it was available for all four nations, and the authors are not aware of counterparts or variations for the Devolved Administrations. Similarly, the Faculty of Intensive Care Medicine, the Intensive Care Society, the Association of Anaesthetists of Great Britain and Ireland, and the Royal College of Anaesthetists set up and maintained a joint website aiming to provide a curated repository for current guidance (as a declaration of interest, GS was a co-editor of the website and CS contributed to some clinical management guidance documents hosted within the site) [Faculty of Intensive Care Medicine et al, 2020]. Such approaches are intuitively helpful and receive wide readership (e.g. in the case of the joint professional body website, reaching 720K views and >300K UK + international users), and we recommend that these are considered in a future pandemic or similar crisis.

27. The Chief Medical Officer for England/Chief Medical Advisor for the UK Government (Professor Whitty) and others, made efforts to ensure important new research findings (e.g. regarding dexamethasone, tocilizumab, CPAP and baricitinib) were communicated to clinicians, NHS managers and others across the four nations of the UK via the Central Alerting System [CAS]. The guidance communicated the required change in clinical practice alongside the arrangements for accessing the new therapy (e.g. the medicine supply process). It aimed to ensure that evidence-based treatment was available as soon as possible across the four nations. We cannot comment on whether there were local implementation issues at hospital sites, but in our view, the efforts to disseminate best practices are to be commended.

The definition and organisation of intensive care.

Levels of intensity in acute hospitals

28. There is a defined gradation of "levels of care" in acute hospitals (technically numbered Level 0-3), used for commissioning, staffing and operational purposes [Intensive Care Society, 2022, originally published 2009]. In more general terms, these fall into several broad categories:

- Ward and enhanced ward care (Level 0-Level 1), with care directed by general and speciality-based hospital medical teams and staff such that a Registered Nurse may be responsible for many patients (ranging from one trained nurse to eight patients or one trained nurse to four patients in enhanced care facilities (Level 1+)). Allied health professionals (physiotherapists, speech and language therapists, occupational therapists, clinical psychologists, etc.) and pharmacists are essential to care and usually cover multiple wards, allocating time according to need.

- Dedicated intensive care units (Level 2 and Level 3) admit critically ill patients (albeit adults and children are treated separately). Intensive care units are overseen by dedicated teams led by intensive care medicine specialist doctors and have a high nurse-to-patient ratio. The terms intensive care and critical care tend to be used interchangeably in this context. Intensive Care Units have one trained nurse per patient for Level 3 care (usually receiving invasive mechanical ventilation) and one nurse to two patients for Level 2, sometimes called high dependency care – in practice, these are typically delivered in mixed Level 2/3 units, with patients moving up or down in dependency and staffing ratio as needed but remaining *in situ*. These staffing ratios allow detailed real-time observation, diagnosis, and treatment of the most unstable, at-risk, and dependent patients. Similarly, regarding doctor to patient ratios, UK-wide national standards [Faculty of Intensive Care Medicine and Intensive Care Society, 2022, chapter 21] define an ICU consultant ('intensivist') to patient ratio as not usually exceeding nine to twelve patients per consultant, and a resident junior doctor (doctor in postgraduate training) ratio of eight patients per doctor day and night. A 2017 study of UK ICUs using ICNARC data showed that the best patient outcome is seen with a ratio of 7.5 patients per consultant, with mortality rising with deviation from this number [Gerschengorn et al., 2017]. In addition, allied health professionals and pharmacists have more allocated time per patient in ICU than in general wards, increasingly delivered by trained critical care subspecialists within each profession.

- Tertiary specialist critical care units, situated in regional or national centres for certain specialities: for example, cardiothoracic, neurosurgery and neurology, or burns. Patients are transferred to such centres for speciality medical or surgical care and the associated specialist forms of critical care. Of most relevance to Covid-19, this includes centres capable of delivering extracorporeal membrane oxygenation (ECMO, see paragraph 9). ECMO requires intensive staffing and technical support and is the most advanced supportive treatment available for respiratory and/or cardiovascular organ dysfunction. It can be lifesaving but only offers temporary support and requires careful decision-making regarding someone's potential for survival, recovery, and benefit from the process.

- The UK Acute Respiratory Failure Centre network - The increasing use of ECMO for non-surgical patients with advanced lung failure, including respiratory viral illness, is a relatively recent development. Following lessons learned in the 2009-10 H1N1 influenza

pandemic, a network of advanced respiratory centres capable of providing ECMO was commissioned by NHSE in 2011, and by the time of the Covid-19 pandemic had treated 1,205 patients from across the UK (patients from outside England, where ECMO may not be available, have accessed ECMO by being transferred to NHS England centres) who were felt to have a reasonable predicted chance of recovery [Warren A, 2020]. As part of this network, there is written guidance regarding the eligibility criteria for patients to receive ECMO [NHS England (2019)].

29. A brief note on terminology: 'intensive care' and 'critical care' are often used interchangeably, although there are nuanced differences. In the UK, 'intensive care' came first historically and has given its name to the associated clinical speciality and training (Intensive Care Medicine). 'Critical care' has risen in prominence, particularly after the report 'Comprehensive Critical Care' [DH, 2000], which emphasised that care of the critically ill is a process and not only a location and may include care delivered outside intensive care units and throughout the patient journey. However, the terms are nearly synonymous and are clarified here only to avoid confusion.

30. It is essential, for the discussion which follows, to understand the step-change in escalation between the wards (which may themselves be specialised and under dedicated teams, e.g. acute medicine, respiratory, surgical, stroke, care of the elderly) and dedicated critical care units. The latter involves a specific decision to commit the patient to more invasive and intrusive forms of care, taking into account the patient's wishes and values, the likelihood of clinical benefit in the opinion of a critical care specialist, and the possible harms, including prolonged dependency and loss of dignity. Analogous to (for example) a decision to undertake major surgery or start chemotherapy, initiating critical care is a specialist-led treatment decision with potential benefits and adverse consequences. It is not merely an unquestioned step in a chain of events. It should be emphasised that these are decisions intrinsic to critical care and made many times a day under normal, non-pandemic circumstances by appropriate specialists in every acute hospital.

31. The discussion of levels of care above puts deliberate emphasis on staff skill, time and attention when discussing levels of care rather than beds and machines. This reflects the fact that the levels of escalation discussed very much reflect the care, supervision, and decisions delivered, as well as the right skills and staff numbers needed to do so, with equipment, space, and furniture being essential but subordinate. There are UK-wide professional recommendations and standards covering all professions, infrastructure, and practice under non-pandemic conditions, with General Provisions for Intensive Care Services covering Level 2-3 critical care facilities and recent (pre-pandemic) guidance on enhanced care covering the development of 'bridging' Level 1 facilities [Faculty of Intensive Care Medicine and Intensive Care Society, 2022; Faculty of Intensive Care Medicine, 2020].

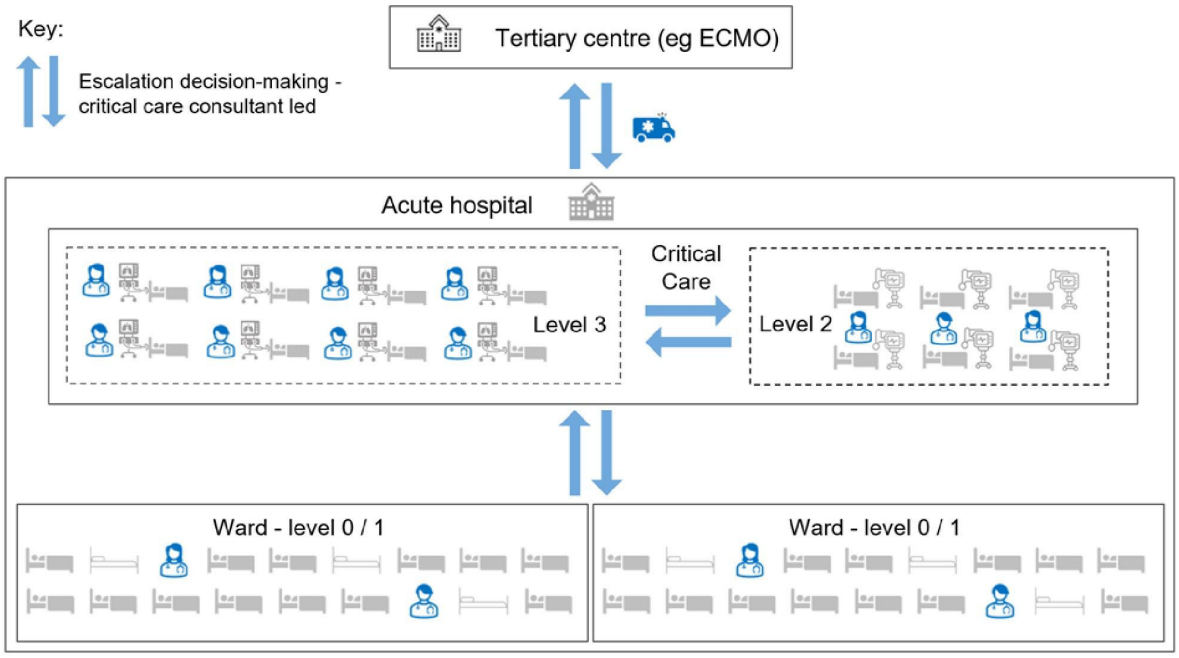

Figure 4: Levels of escalation. Critical care is primarily defined by the ratio of skilled staff, not beds or equipment.

32. These considerations are very relevant to the pandemic. To cope with dramatically increased numbers of patients needing critical care, units were expanded by relying on dilution of staffing ratios, bolstered by redeployed non-critical care staff. This was necessary and appropriate to bring about additional critical care capacity quickly and as safely as possible. However, it came at a cost: firstly, to the staff (both those redeployed and existing critical care staff who had to work in entirely new ways supervising non-critical care trained colleagues and delivering delegated care), and secondly to the patients, both with and without Covid-19, who received diluted care as each unit expanded. When staffing and skills are necessarily spread more thinly, in some places and at some times, then effectively, critical care is potentially being delivered in a compromised way and at a lower level for everybody. This may be pragmatic, expedient, and necessary in a crisis, but it is not an ongoing sustainable form of healthcare nor free of potential harm. In response to a query from the Core Participants, the optimum staffing level is defined in the professional guidance for Levels of Care (e.g. one ICU-trained nurse to one level 3 patient).

33. Although such measures were necessary, the consequences must be understood, particularly when representing and communicating ICU capacity - there were significant national variations in this. In Scotland, Wales and Northern Ireland, ICU activity was expressed and communicated to the government in terms of occupied ICU beds versus the original baseline, in other words, with an effective occupancy over 100% (sometimes by a considerable margin) during the various pandemic surges. An example of Scottish Government data and how it was explained to the public at the time is below:

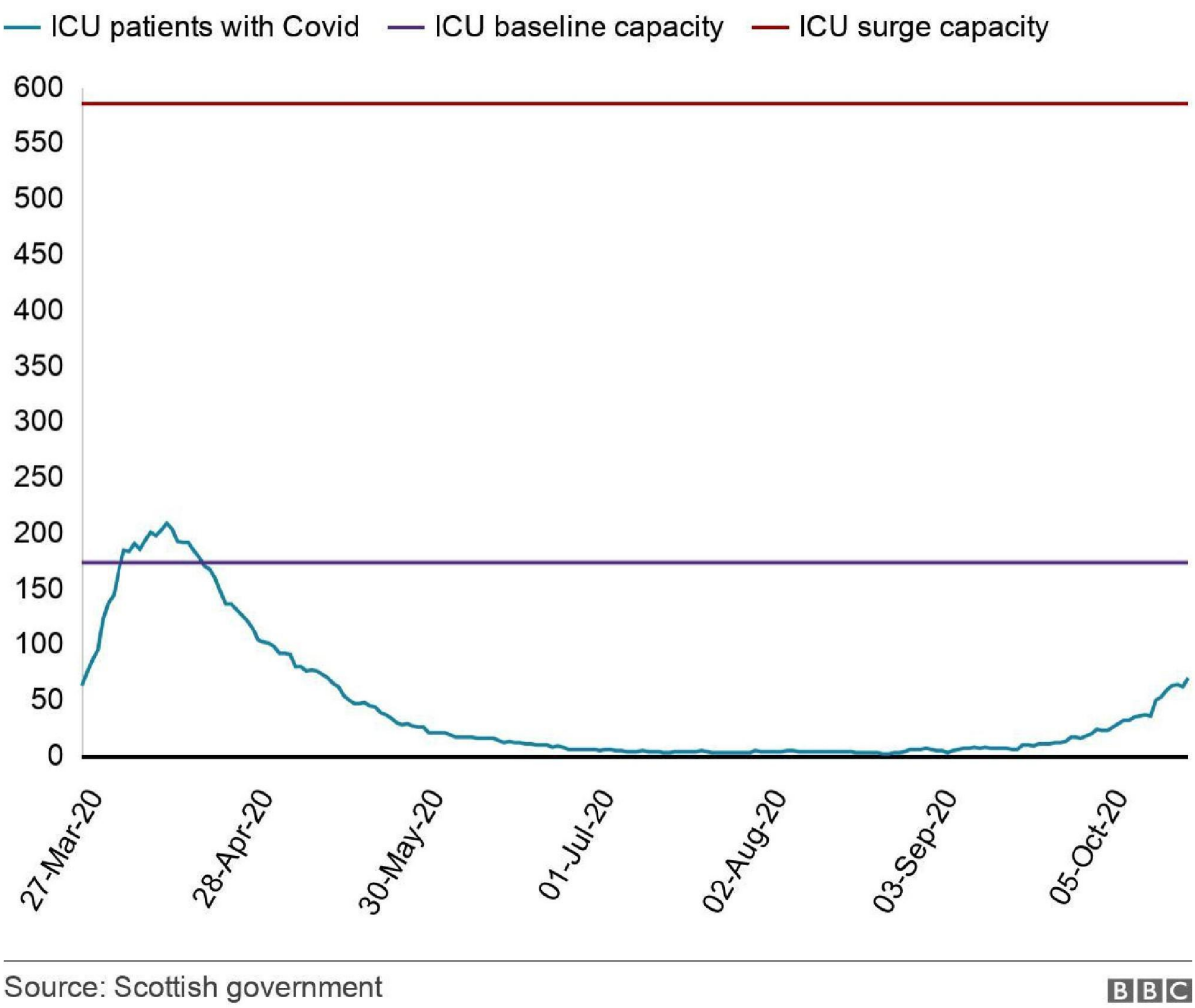

Figure 5: BBC graph (published in October 2020) using Scottish Government data to show the increase in ICU patients relative to both baseline and surge capacity [Brocklehurst S, 2020].

34. In England, by contrast, hospitals were asked to report their theoretical maximum critical care capacity at the beginning of the pandemic – as happened in the other nations – but ICU bed occupancy was then often reported not only internally (within NHSE, and to the Government) but also publicly, as a proportion of this expanded baseline, rather than distinguishing between the existing original and new surge capacity as in the Scottish example.

35. Although both data reporting approaches were taken for appropriate reasons and are intrinsically valid when correctly interpreted by knowledgeable insiders, it is apparent with hindsight that in contrast to the Devolved Administrations, the English approach has

inadvertently led to significant public confusion and a widespread perception (often still presented) that there were many empty ICU beds at every stage [Nelson, 2020; De Quetteville, 2020 - in both cases, the writers acknowledge local peaks]. This is pertinent, as it is an important misunderstanding of critical care and the true nature of the stretched, diluted critical care being delivered in many parts of the country at the height of the pandemic waves. ICU capacity that relies on dilution of staffing and delegated care is a crisis measure which comes at a cost, both to patients (through dilution of usual standards) and, notably, in moral distress to staff.

36. Moral distress is an important concept discussed at several points in this report, but in brief, it refers to psychological harm from 'knowing the right thing to do but being prevented from doing it' – in this case, delivering skilled 1:1 ICU care in the way that staff were trained to do. Moral injury is where sustained moral distress leads to impaired function or longer-term psychological harm [British Medical Association, 2021a]. The psychological effects are known to be cumulative, and there is evidence of a 'crescendo' effect [Epstein EG, Hamric AB, 2009]. These concepts were described long before the Covid-19 pandemic and were known to affect healthcare professionals, but this new crisis provided a perfect storm for widespread moral distress [BMA 2021a].

Advance care planning

37. As mentioned above, unlimited escalation of the degree of intervention is not the appropriate treatment for everyone. This may be a decision made at the time of deterioration and potential treatment, but this carries the risk of rushed and insufficiently informed decision-making. Advance care planning provides a means to make decisions with the best possible information-sharing and patient participation. The onset of the pandemic brought these issues to the forefront for many people, given the urgent prospect of unexpected serious illness.

38. Unfortunately, advanced care planning discussions while "*compos mentis*" are uncommon in the UK, through a combination of (understandable) denial on the part of the public, media taboo, and (also understandable, but perhaps less excusable) defensive reluctance on the part of healthcare providers to raise the topic. In general, people – including healthcare professionals - do not address talking about death, especially a dignified, respectful death, as much as we should. Primary care is often not equipped to have these conversations, and in many cases, non-ICU specialists do not understand what it means when they document 'patient for full escalation', especially regarding the likely outcome versus the burden of treatment on the patient and those close to them. A brief discussion follows of the forms of decision and documentation that may be used.

Do Not Attempt Cardiopulmonary Resuscitation ("DNACPR") notices

39. A DNACPR form is a communication tool that applies specifically to cardiac arrest; in other words, when the heart has stopped, it informs healthcare staff attending an emergency that cardiopulmonary resuscitation (CPR) should not be started or continued. Since there is an urgency to start CPR and the presumption is that CPR will be started unless there is an apparent reason not to, DNACPR forms are designed to be clear, easily identifiable (usually red-bordered on paper or equivalent in electronic records), and quick to interpret. DNACPR forms are specific to each health (or social) care provider, but they are of a generic format and very similar across providers and between UK regions and nations.

40. DNACPR forms exist in settings ranging from the community to social care or healthcare settings. Different documents may be used in each, but a DNACPR notice within a given organisation (such as an NHS Trust, hospital, or Health Board) will apply across all its parts, including wards and ICUs in an acute hospital setting. A DNACPR notice is not meant as a proxy for broader treatment decisions. However, in the absence of clearly documented discussion and decisions about other forms of treatment, there is a potential for inappropriate over-interpretation of DNACPR as a generalised treatment limitation option. This is not an issue with the DNACPR form itself but rather a feature of the fact that open, more comprehensive discussion of treatment options, patient values, and agreed treatment limits where appropriate is not always a routine part of healthcare or indeed of societal expectations, which in turn may place an undue burden on the DNACPR form as a proxy for much broader conversations. Initiatives are underway to change this, discussed below.

41. CPR is, by its nature, a last resort to try and save life after the heart has stopped by trying to keep circulation and oxygen flowing to vital organs while attempting to treat a reversible cause and restart the heart. It can potentially restart a heart in particular circumstances - most often in someone with a primary heart condition who is otherwise likely to recover. However, in people with advanced chronic illness, established very poor health, and/or who are approaching the end of their life from severe acute illness while on maximum treatment, attempted CPR is often unsuccessful and may serve only to cause injury, indignity or defer a natural death. DNACPR documentation was designed to provide a standardised way of documenting anticipatory discussions and decisions to cover these situations, with patient involvement and autonomy, in someone who is at risk of cardiac arrest or nearing the end of their life.

42. Reasons for a DNACPR decision may be:

- Patient choice: someone may decide, in choosing between future possible treatments that are on offer, that attempted CPR is against their wishes and values for reasons of their own. These may include poor individual likelihood of success, loss of dignity, risk of discomfort, perceived quality of life before or after CPR, or informed preference. Such a decision is consequential and, whenever possible, should be taken in circumstances where they have maximum autonomy, complete information with

compassionate explanation, and time and space to think and discuss with those close to them.

- Medical futility (now increasingly termed 'clinical appropriateness'): clinical staff may decide that CPR should not be offered as a treatment, as it would not work for a specific patient and their condition. This should be an individualised decision based on the best and most detailed information available about the patient, including their views and values where known. The decision should be explained and discussed with the patient or those close to them. Neither the patient nor their representatives can demand medically futile treatment. The decision should be reviewed with appropriate frequency, especially if it relates to acute illness and instability. Although medical futility is a clinical decision rather than patient choice, early discussion, while the patient has the mental capacity to participate in such conversations, may offer opportunities for the patient and their loved ones to request a second clinical opinion.

- Best interests: there may be cases where CPR is a medically available and appropriate treatment option, with a recognised possibility of success, but where it may not be felt to be in the patients' broader interests, *and* they are not able to make their wishes known. This complex scenario requires careful consideration, a full assessment of mental capacity (starting from a presumption that the patient has capacity until proven otherwise), involvement of family or other advocates, and a formal 'best interests' decision.

43. There is important, longstanding, UK-wide joint guidance on the principles behind DNACPR decisions [British Medical Association, the Resuscitation Council (UK) and the Royal College of Nursing, 2016; General Medical Council, 2010/2022]. These are now in the process of being updated for (expected) 2025, but currently include the following aspects:

- Discussing the appropriateness of CPR as part of good-quality care for anyone who is at risk of cardiac arrest or approaching the end of their life.

- The patient's active involvement in the decision should be presumed whenever possible.

- The decision should be transparent, clearly explained as early as possible and clearly documented.

- Each decision must be unique and individualised, with no application of a blanket policy.

- Decisions should be reviewed with appropriate frequency, especially if in relation to an acute illness.

- Decisions must be free of discrimination, particularly with regard to existing disability.

- A DNACPR decision is not a proxy for non-CPR decisions and must not compromise the quality of other care.

44. During the pandemic, regulatory bodies acknowledged the pressure on practitioners to make urgent, clinically complex decisions. They emphasised that Covid-19 meant that advance care planning was more important than ever to ensure that patients' wishes and preferences could be discussed and taken into account before the onset of new illness or deterioration and while they had the mental capacity to do so [General Medical Council, Statement on advance care planning during the COVID-19 pandemic, 2020b]. These discussions were to be carried out on an individualised basis, with sensitivity and compassion, and with the provision of support and written information in a way that patients could understand. We wish to highlight this and similar statements as a welcome call for more, earlier, honest discussion of advance care planning with people while they are well and to avoid making the subject a taboo one or one to avoid and defer. This is an important lesson to carry into the post-pandemic world.

45. The Department for Health and Social Care asked the Care Quality Commission (CQC) – the independent regulator for health and social care in England - to review the application of DNACPR across primary care, care homes and hospitals. Its interim report in November 2020 found evidence of overwhelmed providers early in the pandemic and "confusion, miscommunication... unacceptable and inappropriate DNACPRs at the start of the pandemic" [Care Quality Commission, 2020]. This applied primarily to community social and healthcare providers. It found, however, that organisations had made rapid corrections (by reinforcing proper policies, ensuring staff awareness and training, and improving oversight and assurance) and recommended thorough assessments to find and address any remaining inappropriate DNACPR documents.

46. The CQC's final report, "Protect, respect, connect" [Care Quality Commission 2021], goes into more depth and identifies that the pressures of the pandemic heightened existing weaknesses in systems and consistent person-centred DNACPR decision-making. The CQC's role, scope of inquiry, and specific findings were limited to England. However, its stakeholders and expert advisory group members included UK-wide professional bodies, and the lessons and recommendations may be applicable across all four nations. CQC found that many decisions had been taken in a caring and compassionate way consistent with guidance. However, in other cases, DNACPR decisions may have been taken without proper explanation, involvement or meaningful conversations, with potentially devastating impacts on patients and families. It noted reports from people, families, and carers of 'blanket' decisions being made about entire groups of patients rather than after individualised assessments, although provider organisations that were asked did not recognise this practice.

47. The CQC report includes the following in its conclusions:

"All the health and care professionals we spoke with recognised the importance of ensuring that conversations around advance care planning are carried out with kindness and compassion, in line with best practice and people's human rights. But how well people were involved in conversations about their care and whether or not they wanted to receive cardiopulmonary resuscitation varied. Some people experienced compassionate, person-centred care where they were fully involved in conversations, and their wishes were understood and their rights upheld. The impact on people when this did not happen was hugely distressing. In these cases, conversations took place at short notice and people did not fully understand what was happening or what a DNACPR was. Having the time and information to talk about what care and support people want and need to have a dignified and peaceful death is essential. During the pandemic, clinicians, professionals and workers have faced additional challenges in having to hold conversations under pressure and often during emergency situations. A lack of training and support for staff, and how confident they were in holding these conversations, has impacted on the quality of people's experiences. Being faced with unexpected conversations around DNACPR decisions, and having them at a time of crisis was made worse for people and their families and/or carers due to a lack of available accessible information. To ensure people are able to be fully involved in these conversations, there needs to be a consistent approach in the language used and the way that advance care planning and DNACPR decisions are talked about. This needs to be supported by greater awareness of their rights under the Human Rights Act 1998 and the Equality Act 2010".

48. The report speaks powerfully of the challenges organisations faced in dealing with vast amounts of rapidly changing guidance, meetings, and governance mechanisms at the start of the pandemic, which mirror other aspects of the challenges of the pandemic in a complex healthcare system. The final report highlights the importance of broader advance care planning rather than relying on DNACPR in isolation and the need for a consistent approach to comprehensive end-of-life planning, with training, adequate clinician time, proper support for the patient and their loved ones, including written information, and good governance oversight by provider organisations and those overseeing them. We fully support this and the importance of open advance conversations rather than last-minute ones in which the patient may be too unwell to participate or be rushed or unable to understand or feel supported fully.

49. DNACPR documentation fulfils an important role but has some potential drawbacks, all owing to the lack of accompanying broader discussion and documentation rather than to intrinsic flaws in, or misuse of, the DNACPR form itself. Firstly, as it applies only to CPR, it is outside its scope to prompt a more comprehensive discussion of patient goals and treatment wishes other than CPR, which may mean such matters are not discussed. Secondly, when DNACPR is the only documentation of any form of treatment limitation, it also may open the way for potential misinterpretation of DNACPR as a general indication of poor outcomes or a decision to restrict other treatment options, which is not its intended purpose. Thirdly, DNACPR forms are variable between institutions, and communication

about them may be incomplete or inaccurate. For these reasons, a broader approach has developed over the past decade, variations of which were beginning to be widely implemented (albeit still in the early stages) by the time of the pandemic. These are described in the following paragraphs.

Treatment Escalation Planning / Emergency Care and Treatment Planning (TEP/ECTP)

50. Some aspects of decision-making in complex clinical situations are not covered in detail in standard DNACPR documentation, namely establishing a shared understanding of problems and issues, the range of likely outcomes, identification of which of these is most important to patient and family, the treatments on offer, and an agreed set of decisions including specific treatment decisions [Royal College of Physicians, 2020]. A document designed to cover these (including, but not limited to, CPR) is generically known as a Treatment Escalation Plan (TEP) or Emergency Care and Treatment Plan (ECTP) – these are synonymous.

51. There are several examples, but the most widely adopted and increasingly endorsed by national bodies is the Recommended Summary Plan for Emergency Care and Treatment (ReSPECT) form. ReSPECT has been implemented in parts of England and Scotland from 2016 onward via local and regional initiatives. The ReSPECT process and document prompt a structured discussion of more comprehensive emergency treatment options. The goals are to establish a shared understanding of the persons condition, what outcomes they value and fear, and which medical treatments – including attempted CPR – they would benefit from. The form includes an area for documenting a DNACPR decision. Unlike most health or social care DNACPR forms, the ReSPECT form is carried by the patient and travels with them across care settings. The rise of Electronic Health Records (EHR) reduces the risk of loss or lack of access to a paper form, but conversely, can introduce new difficulties of integrating a new form into the sometimes-rigid format requirements of an EHR, as well as interoperability issues between different health bodies using different software.

52. ReSPECT is a standardised approach available for adoption but is not national policy. It is only one form of TEP, and its uptake is at the discretion of clinical and operational bodies at local and regional levels. However, it is endorsed by the Resuscitation Council UK (Four Nations), the Care Quality Commission (in England), and the Health Services Safety Investigations Body (in England) as best practice, and is now the subject of a UK-wide professional campaign for broad implementation [Resuscitation Council UK, 2023]. At the time of the last public update (Autumn 2023), many health and social care trusts in England had adopted ReSPECT, as had a significant proportion of Scottish health and care organisations [Resuscitation Council UK, 2023]. Of those that have yet to adopt, some are considering or planning to, some have no plans as alternative arrangements are in place, and others have no current plans. Implementation across Northern Ireland is currently being planned on a country-wide basis. In London, implementation in some form is likely to be part of the new Universal Care Plan for London [NHS South West London, 2024].

53. The Welsh Government has adopted an All Wales national DNACPR policy for adults [NHS Wales 2015] which is current and under active ongoing review (revised and updated in 2017, 2020, and 2022). A 2024 revision of the All-Wales DNACPR policy is underway at the time of writing (June 2024). A Treatment Escalation Plan document, created by the Aneurin Bevan University Health Board, was adapted after Covid-19 and is now approved to carry the All Wales NHS Wales logo [NHS Wales Executive, 2020]. Like TEPs in general, it applies only in hospital and only for the acute episode in question (it also acknowledges that review may be needed within a given episode if circumstances change).

54. In the context of critical care, ReSPECT and other Treatment Escalation Plan / Emergency Care and Treatment Planning frameworks can have important benefits in encouraging early conversations and helping to clarify the patient's understanding and advance wishes regarding their treatment, including escalation to critical care. By enabling early discussion of treatment options and not just CPR, while the patient is well enough and competent to take part in conversations, and they then become too ill to make their wishes known at the time that urgent decisions need to be taken, then these decisions can take place against a background of informed consent and agreement, or alternative plans can be made in line with the patient's wishes and values.

55. It is important to note that this can and should already occur, under any system. In other words, ReSPECT and other such frameworks are not new policy or a new direction in care, but rather a way of ensuring good practice in line with existing principles of good clinical practice, as cited in paragraph 42. Conversely, they are not a 'quick fix' in isolation, and will only be effective if accompanied by a comprehensive professional education package, clear outcome measures and, importantly, wide public engagement and understanding, in the same way as (for example) organ donation.

56. By abruptly bringing unexpected severe illness to the forefront of national experience for many thousands of individuals and families, Covid-19 highlighted the need to further improve early, informed, compassionate and transparent conversations and individualised escalation planning, taking place before the onset of acute illness or long-term deterioration. This remains an important learning point from the pandemic experience.

57. In our experience, patients often welcome and embrace discussions regarding their future care, wishes and values, and the barriers to this happening more systematically may have more to do with a broader sense of taboo around this topic rather than simply a matter of healthcare practice. People themselves may be more willing to have these discussions than those around them (healthcare workers or families). For example, a study of 1823 older people found that 30% would have been interested in an advanced care planning discussion but only 5% had been offered one [Owen L & Steel A, 2019]. However, although some of the relevant research is in the setting of care of the elderly, the topic clearly goes wider than simply a matter of age. Successfully addressing it requires not only policy but a society-wide change:

57.1 How can we help people be ready to think, and routinely be asked, [about their values and wishes in the event of possibly needing CPR, intensive care, or other aggressive measures in everyday healthcare encounters (including elective surgery and other non-emergency settings)?

57.2 Will people in vulnerable groups or with stable disabilities welcome such discussions as the best way to ensure they can make their views known and access the care they want, or will they be frightened or feel discriminated against by the topic being raised when they encounter healthcare professionals?

57.3 Are healthcare professionals adequately trained, supported and resourced to hold such conversations, not only in emergencies or as a last resort, but in every setting and as a routine part of care, in a full, sensitive and detailed way rather than as simply an additional hasty tick-box in an already highly over-pressured health system?

58. The topic should be an open one with collaborative decision-making rather than a frightening and taboo one. Not everyone will want to have these conversations, just as (to cite a different example) not everyone wishes to think about their organ donation wishes or to discuss them with their family while well enough to do so. Some of this is human nature: everyone is different, attitudes vary, and change takes time to come. Again, these are societal issues rather than purely healthcare-related ones. We are, overall, optimistic that change can be brought about in a mature, open way with a broad, universally understood discussion that tackles complex issues rather than hides from them and in a way that brings full involvement, engagement, and reassurance rather than anxiety, including (especially) vulnerable groups who may have understandable fears about being excluded from treatment without their discussion or involvement. In our view, the answer lies in more discussion rather than less and in normalising the topic for everyone – both the person delivering healthcare and the person receiving it.

Other types of non-legally binding advance care plans:

59. An Advance Statement is a patient-initiated statement expressing what matters to them, their thoughts on how and where they would wish to be treated if they are too unwell to communicate later, and which treatments they would or would not agree to. It can include a statement about CPR, and some organisations have an Advance Statement template that prompts for this.

Legally binding advance care planning documents:

60. DNACPR forms, Emergency Care and Treatment Planning (ECPT) forms, and their specific examples, such as ReSPECT and patients' own advance statements, are all non-legally binding. Healthcare professionals will be aware of them and should take into account what is stated in them. They do not absolutely forbid any particular treatment and may be reviewed, revoked or suspended due to a change in condition.

61. By contrast, an Advance Decision to Refuse Treatment (ADRT), or 'Living Will', is legally binding in England, Wales, and Northern Ireland; it is not legally binding in Scotland, but health staff will take full account of it. It states the conditions under which someone refuses life-prolonging treatment, giving them options as to when this might apply (for example, dementia, brain injury, neurological illness, terminal illness or other specified), and which treatments they would accept (including symptom control). The ADRT takes precedence over the clinical recommendation and the views of family or others close to the patient and prohibits treatment that the latter would not wish under any circumstances. It is, however, important to note that it may apply only to certain diagnoses and conditions specified by patient choice in the Advance Directive – for example, someone might have an ADRT absolutely prohibiting intensive care support in the event of a severe traumatic brain injury, but this does not rule out escalation and ICU care for other conditions such as sepsis.

62. A Lasting Power of Attorney for Health and Welfare (England and Wales) or Continuing [Financial and] Welfare Power of Attorney (Scotland) is a document allowing someone to appoint one or more people to make decisions on their behalf while they cannot do so themselves. The Mental Capacity Act (NI), passed on 9th May 2016, will similarly introduce Lasting Powers of Attorney for Health and Welfare to Northern Ireland once enacted (the previous Enduring Power of Attorney applies to finance and property only and does not have a Health and Welfare provision). The appointed Attorneys may only act while the patient lacks mental capacity and must, like healthcare staff, act according to the principles of the Adults with Incapacity (Scotland) Act 2000, Mental Capacity Act (2005, England and Wales) and Mental Capacity Act (NI) 2016. They may make decisions about health and care, including the right to give or refuse consent for life-saving treatment. Like the patient, the attorney cannot demand treatment that is not on offer in the judgement of the clinical staff.

63. The overall process of Advance Care Planning may involve any of the options above, including a non-binding Advance Decision or the legally binding options of Advance Decision to Refuse Treatment or appointment of a Lasting/Continuing Power of Attorney for Health and Welfare, with the section on life-saving treatment. The UK framework, supported by many and various charity and governmental resources, encourages people to think in advance about the choices they would make for their future care if incapacitated. These arrangements are under constant development but were all in place during the pandemic. [Advanced Care Plan, 2016]

National policy on escalation of treatment

64. In brief, we note the evidence from people consulted by the Care Quality Commission of inappropriate and unacceptable DNACPR decisions being taken locally by overwhelmed organisations (in this case in England) early in the pandemic, with potentially devastating consequences for individuals and families [Care Quality Commission 2021]. It is worth emphasising that it was never national policy to apply DNACPR decisions to entire groups

of people, whether at DHSC, NHS England & or the NHS in the Devolved Administrations, or professional body level.

65. In the acute healthcare setting that we are familiar with, we are not aware of specific groups of patients being excluded from escalation by organisational or 'blanket' policy: usual admission criteria applied from the outset of the pandemic, and this was reinforced throughout the pandemic at national, regional, and local (acute hospital) level [National Institute for Health and Care Excellence, 2021, originally published 2020]. In general, there was increased implementation of appropriate advanced care planning and end-of-life discussions using the existing emergency care and treatment planning frameworks described above. Anecdotally, this has had a lasting and positive impact after the pandemic, with a broader awareness of the need to have compassionate and timely discussions with patients and those close to them early in their course of illness while they can be most actively involved.

66. As discussed above in paragraphs 39-49 in the narrower context of CPR, it is essential to note that irrespective of a pandemic, critical care is not always appropriate for all patients, and individualised, respectful and compassionate but robust clinical decision-making is always necessary when committing someone to intrusive treatments that may prolong death rather than saving life. Differentiating likely benefits against likely poor outcomes is not straightforward, and clinical judgement and expertise will always be involved as to what treatment is realistically on offer. This is intrinsic to routine intensive care practice.

67. Local admissions policies guide such decisions, but all are broadly based on longstanding UK-wide guidelines [Department of Health, 1996] and common principles: that critical care is appropriate for patients who have an acute, reversible component to their illness; whose background state of health and resilience is such that they are capable of surviving and recovering from the current acute illness; and where the patient's consent for escalation is known or can reasonably be presumed, including from conversations with their loved ones.

68. Studies of clinician behaviour patterns before the pandemic (for example, Bassford C et al, 2019) show that while there may be variations among decision-makers, decisions are consistently informed by the same common factors as in the guidelines. Firstly, the severity, perceived treatability and potential reversibility of the acute illness that has led to critical care referral. Secondly, the patient's functional status, comorbidities and frailty before the current episode, and thirdly, the patient's perceived wishes and values as expressed by themselves or their advocates. This continued to be the case during the pandemic.

69. This means that there are some patterns of long-term ill health or poor biological reserve, which may make someone less likely to be escalated or admitted to critical care. However, this would still be through individualised decision-making, in combination with all the other factors described above. Their state of health before acute illness would contribute to the decision but would not automatically rule them out. It should not, therefore, be the case

that entire groups of people are excluded by a particular characteristic, whether under normal circumstances or in a pandemic.

70. As discussed above, a DNACPR notice should apply only to the act of CPR itself. It is not intended to advise on or limit other forms of treatment. However, there is qualitative, pre-pandemic evidence that the presence of a DNACPR notice can influence the provision of other treatments in acute medicine [Cohn S et al., 2013] [Fritz 2013] and elsewhere, and that despite the intended use, 'do not resuscitate' can become inappropriately conflated with 'do not provide active treatment [Perkins GD et al., 2016]. Looking forward, the best ways to address this are likely through developing and implementing more comprehensive structured decision aids and advanced care planning documentation, as already discussed, with extensive training and sustained changes in practice.

71. During the pandemic, there were observable changes in practice with increased senior decision-making and improved pre-emptive documentation of DNACPR decisions where appropriate [Coleman JJ et al., 2020]. This likely reflects a pattern of better, more senior-led practice under surge conditions, with a higher rate of pre-emptive discussion and earlier clinical decision-making regarding escalation – in other words, an improvement in appropriate and consistent practice- but it is difficult to assess whether this was the case.

Identifying at-risk and critically ill patients

72. Of potential relevance to identifying at-risk patients, and the appropriate decisions and delivery of critical care, there are numerous scoring systems designed to link a patient's physical parameters with their illness severity and potential outcome. Some are generic, while others were developed rapidly for use in Covid-19, using data emerging during the pandemic. One, the ISARIC-4C score, may offer a methodological model for how emerging data can rapidly produce accurate prognostic scoring during a future pandemic.

73. There are some important caveats. Firstly, all scores are cognitive and communication aids but do not replace clinical judgement. Secondly, there is no single predictive score relevant to the entire patient journey - each has its niche in the patient trajectory and its role in the assessments that need to be made at every step. Thirdly, it is essential to emphasise that no score is currently intended, or was used, as a triage tool in the UK. Finally, these patient-based scores were not used to track the progress of the pandemic or the national response; instead, this need was met by CRITCON and other measures of ICU capacity strain.

74. Scoring systems relevant to Covid-19 and critical care fall into the following categories:

Tools to identify patients in wards and emergency departments who are at higher risk of deteriorating and dying to aid in prompt escalation and treatment decisions:

74.1 Version 2 of the **National Early Warning Score (NEWS2)**, last updated in 2017, was developed as an alert tool for patients deteriorating on the ward or as part of

Emergency Department assessment. It applies and is available for use across the United Kingdom, and was derived from the Modified Early Warning System, first presented at an Intensive Care Society conference in 1999 and subsequently first validated in a major study at Wrexham Maelor Hospital in Wales [Subbe CP et al., 2001]. It combines six routine nursing observations to identify a pattern of life-threatening deterioration at an early stage. It is part of bedside nursing charts, and its strength is that it does not require specific extra tests or analysis and applies to any patient regardless of disease pattern. It does not aim to predict outcomes. It is well-established as an escalation and early warning tool and linked to call-out triggers for medical emergency teams, and as such, it continued to be widely used during the pandemic.

74.2 More specific to community-acquired pneumonia, **CURB-65** (named after its constituent parts: Confusion/blood Urea/Respiratory rate, Blood pressure, over-65) combines scores for each part to identify patients as low, intermediate, or high mortality risk. It is a useful 'front door' risk identification tool and communication aid but has not been validated for Covid-19.

74.3 Frailty scoring to identify patients who are physiologically more vulnerable to, and may have impaired ability to recover from, acute illness using the Rockwood **Clinical Frailty Score (CFS)**. This aims to capture and describe, in short, numerical form, a patient's background state of health, biological reserve, and likely ability to recover from an acute event. The score uses lifestyle, mobility, and care needs (described two weeks before hospital admission, a distinction often lost on teams referring to ICU) as accessible proxy markers for biological resilience. It has been validated in the over-65s and correlates with the overall likelihood of death during an admission, both in general [British Geriatrics Society, 2014] and with respect to Covid-19 [Kastora S et al., 2021].

74.4 There are important caveats - the Clinical Frailty Score must be used cautiously and only as part of a holistic assessment [NHS Specialised Clinical Frailty Network, 2023]. Firstly, the score is not validated in younger patients under 65. Secondly, and importantly, the nature of the indicators used and their emphasis on activity, mobility and independence may overestimate the risk of a poor outcome in people with stable conditions such as cerebral palsy or learning disability. In these patients, a higher clinical frailty score may reflect their stable disability and not, as intended, the overall ability of the body to recover from biological stresses at tissue and organ levels.

74.5 Although the original version of the Clinical Frailty Score uses convenient visual shorthand imagery (e.g. walking, stooping, or bedbound adult figures) to indicate frailty and infirmity for rapid scoring, it has become apparent in discussions with patient and age advocacy groups that the graphics used may be felt to be unintentionally demeaning by patients or families.

Physiological scoring in critical care:

74.6 Once a patient is in critical care, the **Sequential Organ Failure Assessment (SOFA)** uses multiple parameters appropriate to this environment. It was designed as a population measure and primarily for sepsis research. In common with other scores, SOFA is not specifically designed or able to predict individual survival (i.e. if it predicts a mortality of 80%, it cannot identify which 20% of the patients will survive).

74.7 It is potentially helpful in identifying patient trajectory, response to treatment, and (for example) highlighting deterioration or failure to recover. Its clinical utility has yet to be proven, but it may add a valuable communication and trend analysis element. As with the other measures, it augments rather than replaces clinical impression and narrative documentation. SOFA is over 25 years old and arguably due for an update as clinical practice has evolved [Moreno R et al, 2023].

74.8 Given that it provides a numeric measure of severity and instability, the SOFA score (outside the UK) has been proposed for triage and end-of-life decision-making purposes in a pandemic context [Christian MD et al., 2006]. However, this approach has not been part of the dialogue in the UK [Aziz S et al., 2020] and is not the intended purpose of the score.

Covid-specific scoring systems

74.9 The **International Severe Acute Respiratory and Emerging Infection Consortium (ISARIC)**, a data-led global scientific collaboration (in effect, a coming together of research networks) developed a Covid-specific scoring tool at pace through the **Comprehensive Clinical Characterisation Collaboration (4C)** using UK data from patients hospitalised with Covid-19 [Knight SR et al., 2020]. The score of the same name represents the most accurate predictive score to date for acutely ill (hospitalised) Covid-19 patients, as it was developed and validated for this disease.

74.10 Although ISARIC-4C is the best available numeric predictive score for Covid-19 outcomes, it is not in general clinical use as, despite the impressive rapidity of development, it was not published and available for use by the time of the first wave peak. Like any other scoring system (albeit in this case with higher reliability), it is intended for use only as part of a decision process, clinical judgement always taking precedence. This score is specific to Covid-19, but the successful methodology of building and using such a platform with live emerging data from a pandemic as it develops may provide transferable lessons for the future. In this context, it should be highlighted that the infrastructure underpinning the ISARIC Consortium's ability to deliver essential and actionable contributions to outbreak responses -including clinical case characterisation, risk prediction and biological sample analysis to understand an outbreak - receives no sustainable funding, despite its demonstrated importance.

74.11 **QCovid** is another validated, Covid-19-specific tool which is accessible to people to assess their own living risk of serious illness from Covid-19 infection and which may be of benefit to public health policy and protective measures. It is of little relevance to critical care. [Clift AL et al., 2020]

Inter-hospital critical care transfers

Supporting information was kindly provided by:
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Dr Richard Browne, National Critical Care Transfer Lead, NHS England & Lead Consultant ACCOTS Adult Critical Care Transfer Service, Midlands

75. Critical care transfer exposes seriously ill people to potential additional risk. As such, the decision-making, patient selection, planning and execution involved all require careful thought for the reasons explained below. Critical care transfer may be necessary to move people for clinical escalation to specialist care that is not available at their current location, or for non-clinical (capacity) reasons - in other words, because the right facilities exist in their current location, but the hospital has run out of staffed critical care beds. Non-clinical transfer was an important mechanism of decompressing over-stretched ICUs during the pandemic, but it has an obvious potential impact on patients and their families, as well as an important element of moral injury to referring teams who find themselves subjecting the patient to a transfer that they would not have chosen as best practice. All of these make it all the more important that firstly, the need for non-clinical transfers is minimised by ensuring that ICU capacity matches need whenever possible, including enough 'headroom' for foreseeable variations in demand; and secondly that all transfers, clinical and non-clinical are well-selected and conducted as safely as possible. In general, patients and families are understanding of service requirements, but this is not always the case and challenging situations do arise.

76. Although critical care transfer can be delivered on an *ad hoc* basis with available and suitably trained local staff and appropriate equipment and vehicles, it can be delivered more consistently through systematic commissioning and investment, with dedicated staffing, coordination and infrastructure. In the case of general adult critical care, this was rare and unevenly available in the UK before Covid-19, with Northern Ireland leading the way from 2017 onwards (see para 82). A positive outcome of lessons learned from the pandemic, is that the sustained development of such services is now well underway across the UK. The role of transfers in load-balancing and evening out localised capacity strain on ICUs under surge conditions is discussed below.

77. Critically ill patients are intrinsically physiologically unstable, more so at some stages of their illness than others. However, this can change rapidly, and patients are thus highly dependent on close observation, continuous nursing and medical care, and continuity of

technological support (airway devices, mechanical ventilation, drug infusions and in some cases, body compartment drains or extracorporeal circulatory support). Movement between sites involves physical support interruptions, such as changing to a portable ventilator, which can disrupt organ function even if brief. Coupled with this are the risks of life-threatening accidents (obstruction, disconnection or displacement of tubes and devices, failure of batteries or oxygen supply, other equipment failures) and the challenges of working in a confined remote space without the support of a hospital team and equipment in the event of deterioration. The physical effects of movement, including acceleration, temperature or (in the case of aviation) pressure change, can be potentially harmful. All of these aspects are amplified with greater distance and duration of travel.

78. From this, the questions arise as to whether to transfer someone, when, and how to achieve it most safely. There are three reasons to transfer a critically ill patient, all of which need to be balanced against the theoretical risks. Firstly, for clinical need and escalation of care, i.e. to benefit from specialist skills and treatment or support which are not available where they are, as described in paragraph 28. Secondly, a stabilised and improving patient may be repatriated to continue their recovery closer to home. Thirdly, a transfer may be for capacity reasons, such as a lack of available staffed critical care beds in a hospital that otherwise has all the necessary facilities and treatment options. Capacity transfers have been regarded and remain a last resort in UK adult critical care. They are widely used as a metric of shortfall in local capacity. For example, 'non-clinical transfers to another unit' is one of eleven quality measures in the national ICNARC Quarterly Quality Report for each ICU, alongside others such as delayed discharge and unplanned readmissions [ICNARC, 2024]. Unlike transfer for escalation of care or repatriation closer to home, which are more clearly in the patient's own best interests, transfer for capacity reasons is not an advantageous option for the patient themselves, either when they are a new admission to ICU or when they are established in an ICU bed but are moved to create capacity for others.

79. In a transfer for clinical escalation, the choice of patient will be self-evident, and the transfer timing will be driven by clinical urgency and the potential for stabilisation before transfer. In a repatriation or capacity transfer of an existing ICU patient, it is essential to minimise their risks. Firstly, by choosing the most appropriate patient. Secondly, by ensuring they are in the most stable possible condition – recovering and undergoing stable weaning from support or when this is not possible, that they are not currently destabilised by active complications such as severe infection, circulatory failure or worsening lung function. This is a matter of clinical judgement and the bar should be set appropriately high when the transfer is not for the patient's individual benefit.

80. At the individual patient level, the organisation of a critical care transfer involves bringing together a trained clinical transfer team, appropriate transfer equipment including a ventilator, continuation of key drug infusions, emergency drugs and equipment to deal with unexpected events, with a suitably equipped ambulance and crew. This can be done with the originating hospital providing the transfer team (depleting its duty shift personnel to do

so) and equipment (using emergency NHS or private ambulance providers); or using a funded dedicated critical care transfer team to provide their equipment and vehicle access, with regional or national coordination. Before Covid-19, the dedicated transfer team model was mainly limited to services needing specialist retrieval due to a lack of clinical familiarity and expertise at general sites (neonates, paediatrics, or, in the case of adults, notably ECMO). The response to the pandemic brought about a substantial change in service provision as detailed below and is an important positive outcome.

81. Internationally, there is a longstanding precedent for co-ordinated, separately staffed escort teams for all critical care transfers, but this also reflects different geographic factors and organisational history (for example, the large distances in Australia and Canada make organised transfer systems a necessity, while in France, all emergency ambulances are staffed by Emergency Department medical and nursing teams, who also conduct interhospital transfers).

82. In the UK context, the Northern Ireland Specialist Transfer and Retrieval (NISTAR) system brought neonatal, paediatric, and adult transfers into a fully funded, co-ordinated 24/7 service from 2017 onwards, hosted by Belfast Health and Social Care Trust (BHSCT) in partnership with the Northern Ireland Ambulance Service (NIAS) and transferring approximately 1,400 patients of all age groups per year [NISTAR Annual Report, 2021].

83. The Emergency Medical Retrieval System (EMRS) has existed since 2008 in Scotland. It conducts mainly primary (pre-hospital and trauma) transfers, with some scheduled secondary transfers from 24 rural hospitals inwards to Central Belt sites. The larger hospitals in Scotland continue to organise their outgoing transfers *ad hoc*.

84. In England and Wales, a regional Critical Care Operational Delivery Networks (CC-ODN) system has existed since the Comprehensive Critical Care Report of 2000. Within this framework there are many pre-pandemic examples of shared transfer training programmes, governance, and collaborative work within each network. These formed the basis of the shared Covid-19 response in each area.

85. In many cases, CC-ODNs had identified a funded staffed transfer service as the next logical step in service improvement prior to the pandemic. However, no identified regional or national funding mechanism had been identified. This was highlighted in several national reports and guidelines [Healthcare Safety Investigation Branch, 2019; Faculty of Intensive Care Medicine & Intensive Care Society, 2019; Association of Anaesthetists, 2019] and was best summarised by a South West Critical Care Network paper published in early 2020, which studied 1,124 patients transferred by an *ad hoc* regional system from 2012 to 2017. The paper identified a 6.9% rate of critical incidents and an 18.1% incidence of delayed transfer, usually due to vehicle availability [Grier et al, 2020]. It is difficult to assess the impact on overall patient outcome, given that the transfer makes up a relatively short interval in an overall ICU stay of days or weeks.

Critical care transfers during the pandemic

86. The Covid-19 pandemic led to the rapid establishment of temporary transfer services in those areas and nations that did not already have them, initially unfunded and staffed within regional networks on a volunteer basis, to facilitate the movement of patients between hospitals to balance critical care capacity. In some cases, this was necessarily at a very high tempo, demonstrated, for example, in the North West London Critical Care Network [Pett et al., 2022]. At the peaks of the surges, the hardest-hit hospitals were transferring multiple patients a day between each other, with ebbs and flows depending on case mix and activity. In Spring 2020, this largely consisted of local decompression of overwhelmed sites, with flows and destinations determined by immediate availability. However, regionally coordinated, longer-distance and centrally organised transfers came into play in later pandemic waves.

87. Illustrations from North West London referenced above help to graphically demonstrate the first point and some of the early timelines involved, showing first the degree of saturation at one hospital during Spring 2020 (Northwick Park, with a baseline critical care capacity of 24) [Fig 6] and secondly how a large number of critical care transfer outflows per day were necessary [Fig. 7]. Incidentally, this example also shows the difficulty of interpreting occupancy against a theoretical baseline using the methodology of comparing occupied beds against theoretical maximum, since this hospital would have appeared to be well below 100% of theoretical ICU occupancy most of the time, even though in reality it stretched to 230% of usual ICU capacity at the peak of Wave 1.

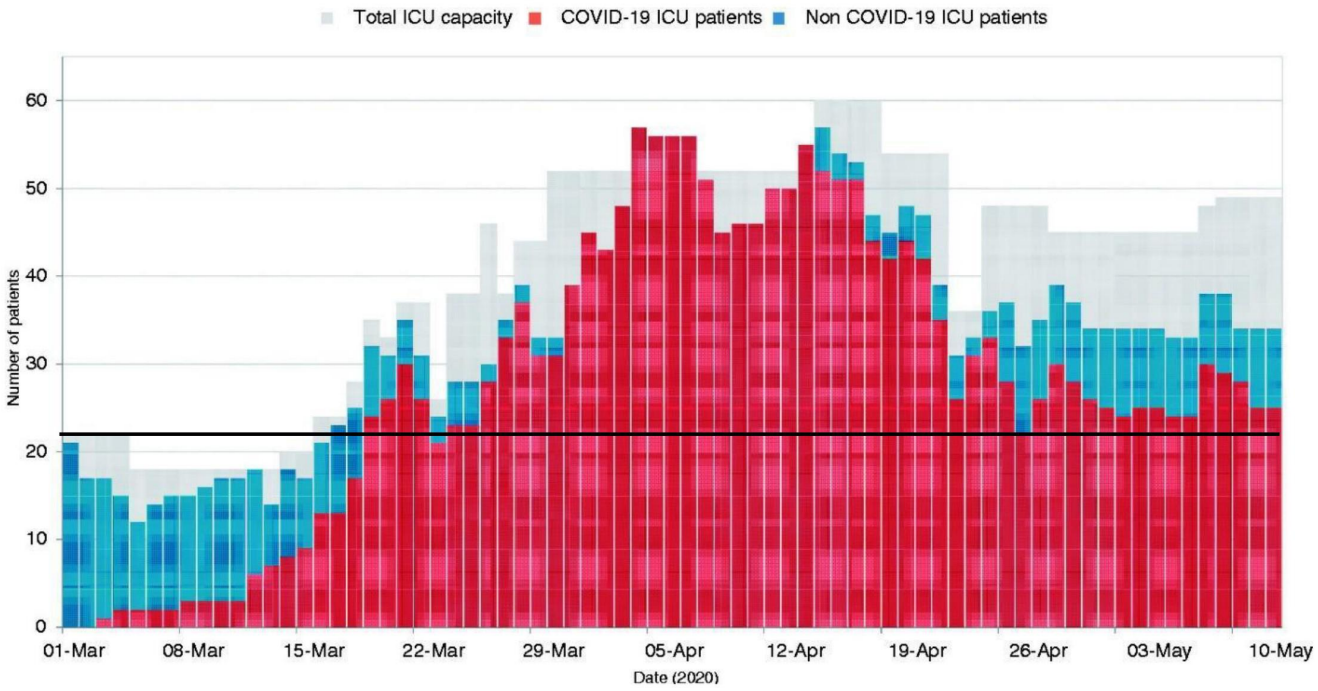


Figure 6: Daily ICU bed capacity, COVID-19 and non-COVID-19 bed occupancy at a sample UK hospital (Northwick Park, London). Line added at 22 beds to show baseline capacity. Adapted from Pett E et al., 2022.

88. Thirdly, the flows across the region, range of destinations, and number of patients sent to each are shown [Fig 8], illustrating the mutual aid that allowed each hospital to mitigate near-saturation at different stages in Wave 1 in this part of London. Academic institutions, specialist cardiothoracic centres, and the London Nightingale were providing extensive mutual aid to the general hospitals with unselected Emergency Department admissions.

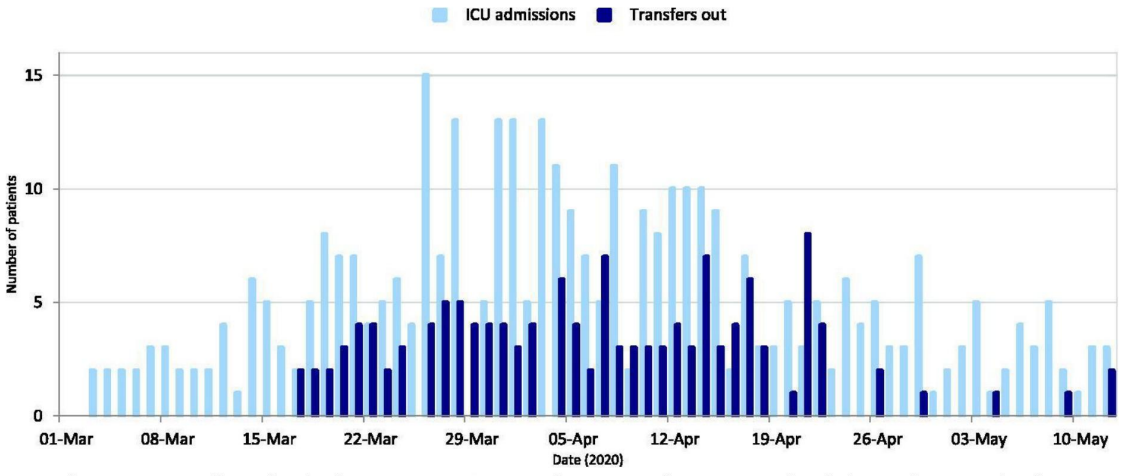


Figure 7: Daily admissions to and transfers out from Northwick Park Hospital ICU. Pett E et al., 2022.

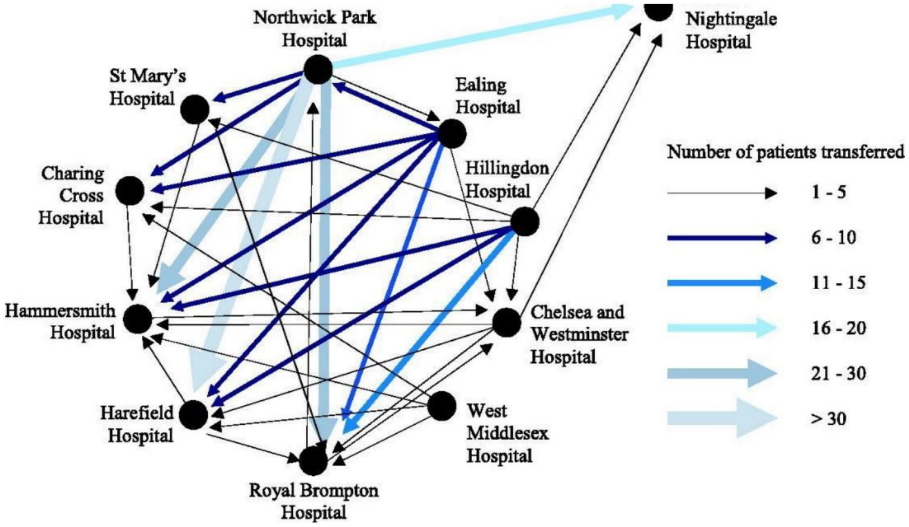


Figure 8:Transfers by location and volume within North West London Critical Care Network from 17th March to 6th May 2020. Pett E, et al., 2022.

89. By Wave 2, there was an increased understanding of, in particular, the damaging effect of stretching staffing to high ratios [Greenberg N et al., 2021]. Maximum staffing ratios were adjusted from 1:6 to 1:4 ICU trained nurses to patients, and during Wave 2, many of the busiest hospitals were decompressed before reaching the peak occupied bed numbers seen in Wave 1. There was a greater emphasis on load-balancing between ICUs at regional and

national levels, including moving patients between regions. This, coupled with the greater overall size of Wave 2, correlates to an increased number of Covid-19 transfers over Winter 2020/21 compared to the Spring of 2020. A similar approach was taken in Wave 3 in mid to late 2021, with a lower overall scale of surge. This explains the pattern of Covid-19 transfers seen in national data [Figure 9].

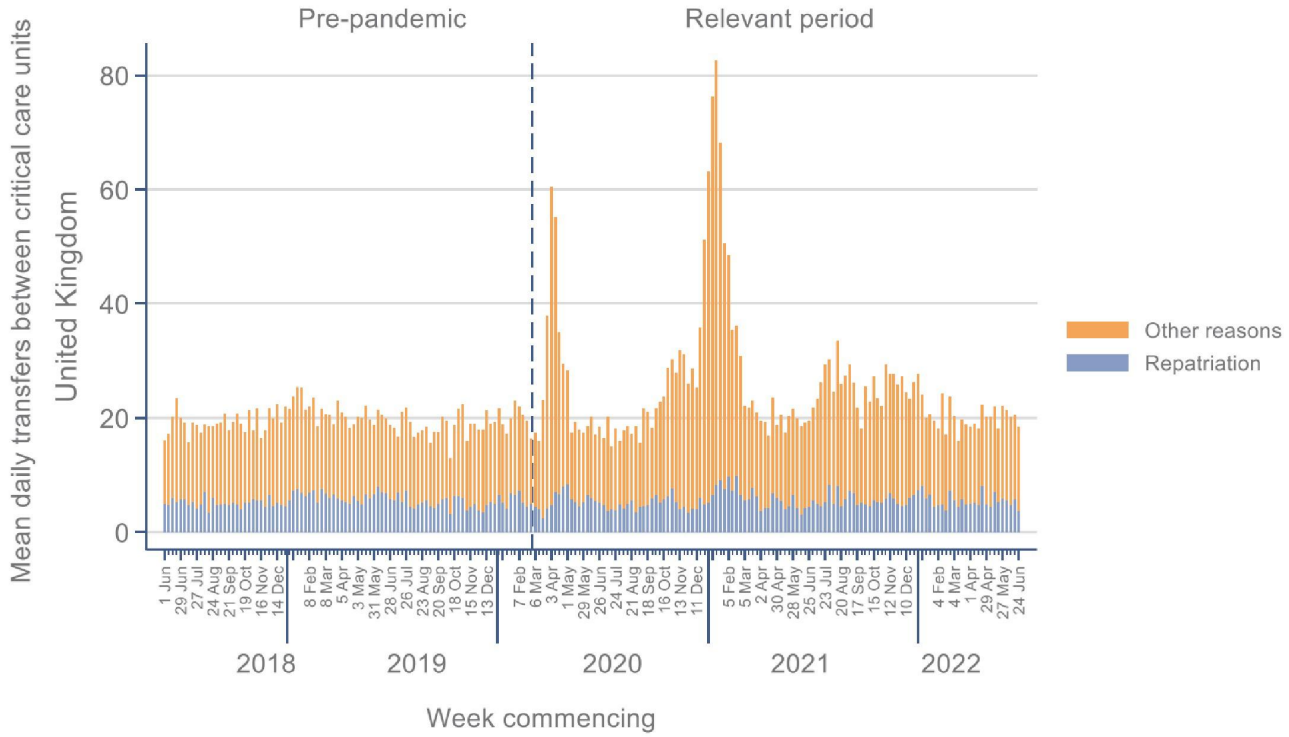


Figure 9: Average daily number of ICU transfers between critical care units across the UK per week, 1 June 2018 to 30 June 2022. Source: ICNARC and SICSAG, INQ000474239, pg 17-19

Outcomes and lessons learned regarding critical care transfers

90. Assessing the overall impact of a critical care transfer on a patient's eventual outcome from intensive care is difficult, as the transfer is a relatively short time interval in an ICU stay of days and weeks. During this time, multiple other factors can influence patient survival. A study of 137 Covid-19 ICU transfers in North West London demonstrated a short-term deterioration in lung function, with no difference over 24 hours and with no impact on survival, appearing to suggest that critical care transfers of mechanically ventilated Covid-19 patients can be conducted safely and with no lasting effect [Huq et al, 2022, INQ000056471]. However, this study was in a densely populated urban area where the hospitals are within a short distance of each other, and the analyses were not adjusted for potential confounding factors (that is, other factors that might influence the results, such as the patients' ages).

91. Another study used data from 108 patients admitted to a unit in Scotland in the second wave. After adjusting for several possible confounding factors, they found no significant difference in mortality rates for patients who were transferred for capacity reasons compared to those not transferred [Stark and Chohan, 2023].

92. By contrast, other studies have found evidence of possible risks to patient safety from capacity transfers. A large Swedish study of 11,176 transfers before the pandemic found that, after adjusting for several possible confounding factors, capacity transfers were associated with a 25% increase in the odds of mortality within 30 days when compared to repatriation transfers [Parenmark and Walther, 2022]. Notably, this study was not comparing patients transferred for capacity reasons to patients who were not moved, which may be the more relevant comparison.

93. Overall, the evidence on risk to ICU patients of inter-hospital capacity transfers, particularly in pandemic conditions, is not yet conclusive. More robust data on outcomes should emerge in future as co-ordinated adult critical care transfer systems come into place and their associated audit data begins to be analysed.

94. Following initial work in 2020, NHS England developed and commissioned dedicated Adult Critical Care Transfer Services (ACCTS) [NHS England, 2021]. These began to be formed during 2020 and, in some cases, were in place for the second wave. Although commissioning was initiated during this period, the details and timing of full implementation have varied from region to region, with *ad hoc* systems continuing to play a part in the interim. Together, they took an effective part in critical care capacity management, working under the National Critical Care Transfer Cell (NCCTC) and Critical Care Capacity Panel (CCCP) to coordinate the long-distance transfer of critically ill adults and to support regions to deliver transfers within their geographical areas. Full implementation across England and Wales continues, with progress in all areas. Some English regions are beginning a full 24/7 service in 2024.

95. Since 2021, ACCTS have evolved and are now vital components of each region's critical care delivery [Grier S, Browne R, 2022]. NHS England has a programme to develop dedicated ACCTS across all seven English regions. Their commissioning and activity (transferring 20,000-25,000 critically ill adults per annum) impacted adult critical care across the country, and they are a positive legacy of the Covid-19 pandemic.

96. There are a variety of systems across the Devolved Administrations. In Northern Ireland, Northern Ireland Specialist Transfer and Retrieval (NISTAR) is fully established as a 24/7 consultant-delivered service responsible for all transfers (except airborne ECMO retrievals to mainland UK, which the relevant ECMO centre organises). In Wales, the ACCTS is fully funded for daytime cover, while night transfers are conducted by the Emergency Medical Response and Transfer Service (EMRS) (in other words, the agreed use of the Welsh pre-hospital service to provide night cover for the inter-hospital service). In Scotland, the geography of population and ICU distribution means that the Emergency Medical Response

Service (EMRS) system focuses on prehospital care, trauma, and rural hospital support and retrieval. In contrast, in Scotland, transfers between major urban hospitals remain ad hoc and organised by the originating hospital, as before the pandemic.

97. A review of needs and planned provision across all four nations and administrations would be beneficial. It is difficult to make specific recommendations within the scope of this report, as the geography and distribution of patients, services, transfer needs, and specialist skills and facilities vary widely, so requirements are best identified at the appropriate regional and national levels. Funding is, in all cases, within the remit of individual national and (in England) regional NHS commissioning bodies. However, an important principle applicable to all regions and nations must be that all critically ill patients should have universal, timely and equitable access to the full range of critical care services that they need, regardless of local strain on service provision and that every area should have access to a transfer system that enables this. The widespread and substantial moves toward universal implementation of this principle, where such needs may have been previously under-recognised and underfunded, are a significant positive outcome of the UK pandemic response.

98. Although the available evidence suggests that the benefits of critical care transfers in well-selected patients outweighed the risks and enabled vital mutual aid between ICUs during the pandemic, this came at a cost to patients, who woke up in a different town; to families, who (albeit visiting was already restricted) had the added anxiety of knowing their loved ones were not only isolated from them but physically far from home; and importantly, in causing further moral injury to staff in the units that were transferring out. As well as feeling they were unable to deliver care as they would have wished, the most pressured units also had to deal with the psychological impact of transferring out usually the most stable patients who were most likely to survive and recover (while worrying about putting them at theoretical risk) and keeping the sickest and most likely to die. This meant that staff had more of the moral burden but less of the reward of seeing people get better. Decision-making as to who to transfer had to be local, but sometimes was forced by non-clinical reasons. Some units were transferring out sicker patients that they would not have otherwise chosen due to refusal or even threats from the families of more appropriate and more stable ones. Future mitigations might usefully include mechanisms to support these decisions at the regional (England) or national (Devolved) NHS level to reduce the cognitive and emotional load on the clinical teams.

CRITCON (UK Critical care readiness Condition)

99. The discussion of critical care transfers to avoid hospitals becoming locally overwhelmed raises the question of how to assess and communicate strain on critical care, and how to manage the risk of any given ICU becoming overwhelmed. The CRITCON tool currently in use in England was initially developed for pandemic use in 2009 and is discussed here for background. It is not formally in use in the Devolved Administrations (DA), as the

differences in size and complexity of the DA health systems compared to England means that measures of ICU strain may be more directly communicated within the various national NHS bodies and to each national Chief Medical Officer and Government by acute and critical care clinical leaders [source: direct conversations, contemporaneous and recent, with lead clinicians of Operational Delivery Networks in Wales and NI, and the Scottish Intensive Care Society and SICSAG which had a similar operational role in Scotland].

100. In December 2004, following outbreaks of avian influenza (H5N1), a Canadian expert clinical group was commissioned to develop a proposal for a critical care resource triage system (Christian MD et al., 2004). The proposal, intended as a starting point for discussion, considered inclusion and exclusion criteria combined with a potential triage tool based on the Sequential Organ Failure Assessment score described above.

101. During the early stages of the 2009 H1N1 influenza pandemic, various discussions began around the possibility of resource exhaustion, and a Canadian-style SOFA-based proposal was raised as a possible model for the UK. This did not gain traction, and by contrast, a group of clinicians (GS included) developed what became the CRITCON escalation system [Intensive Care Society, 2021, 'CRITCON Levels: what they are for and how they are used']. It was initially developed by North West London and Surrey Critical Care Networks and was then refined and agreed upon via the London Pandemic Influenza Critical Care Group. It was adopted in 2009 by the (then) London Strategic Health Authority (SHA) and subsequently agreed upon as a pandemic communication and escalation tool by all nine SHA Flu Directors in England.

102. CRITCON was based on the idea that with rapid, frontline-led and easily interpreted reporting of strain at the unit level and co-ordinated escalation, it should be possible to maximise load-sharing between hospitals. This includes shared escalation, mutual transfers and co-ordinated elective cancellation, thus avoiding the scenario of any single hospital or its ICU becoming overwhelmed. In other words, a collective approach to frontline-led reporting that accurately reflected the risk of approaching local triage (occurs in the situation where demand outstrips supply), as assessed by the same on-the-ground people who might find themselves making such decisions regarding the allocation of care resources when supply exceeds demand, which enabled a collective principle that "we all escalate together, and no one triages until everyone triages". A threshold or prioritisation system for use in the event of capacity saturation was not developed or implemented during the 2009 influenza pandemic, but this collective escalation and load-sharing approach was adopted as the first (and arguably most important) part of a putative clinical prioritisation framework in 2020, of which more below.

103. The first version of CRITCON remained in use for winter pressure reporting purposes from 2010 to 2021 - alongside and complementing NHS England's subsequent Operational Pressures Escalation Level (OPEL) - in some parts of England but was dormant in others. It was reactivated more widely in England during the early stages of Covid-19. In Wales, Scotland and Northern Ireland they used similar or aligned systems but not CRITCON itself.

104. The efficacy of CRITCON relies on a clear shared understanding of its use and interpretation. It is intended to relay an accurate picture of frontline strain and, as such, is a deliberately subjective but reproducible qualitative measure to be reported by clinicians. It must not be overridden or 'gamed' to make a hospital, Trust, or Region appear better prepared or under less strain than it is. Where a frontline clinical report shows a high CRITCON score whilst a numerical occupancy-based assessment seems to show less strain, the former should be assumed to take precedence until proven otherwise.

105. More recently, a UK-wide professional body has released an updated CRITCON definition, which is available to all health systems if desired [Intensive Care Society, 2023, 'Guidance: CRITCON levels']. This version was formally adopted and made intrinsic to NHS England Directory of Services (DOS) capacity reporting systems on 14 August 2023 and incorporated into surge guidance for England [NHS England, 2024]. CRITCON is now reported and collected twice daily from all Adult Critical Care Units in England, alongside occupancy and staffing data. We note and welcome the integration of CRITCON into regional and national surge planning.

106. With regard to the Devolved Administrations, CRITCON has remained an England-specific tool up to, during, and after the pandemic. To our knowledge there are no specific equivalent tools or descriptors of frontline ICU strain in the other nations. The report authors (one of whom was involved in the origination and nomenclature of CRITCON in 2009) are relatively agnostic as to the disparity between England and the other nations, as it is primarily a matter for national decision. However, there are clear potential benefits in harmonised vocabulary and communication of operational strain across the UK. This is ultimately a decision for the national Governments and NHS bodies, but our recommendation would be to adopt a harmonised, easily replicable and understood system of strain reporting across the UK.

Clinical prioritisation in the event of a system under strain

The development of a putative prioritisation framework

107. An unchanged policy of usual clinical decision-making remained in place across all four nations throughout the pandemic, meaning that patients should have continued to be admitted to intensive care based on the clinical judgement of their ability to survive and benefit from treatment, using standard criteria and clinical judgement. Early guidance from national bodies [General Medical Council 2020; British Medical Association 2020; Royal College of Physicians, 2020] emphasised the need to apply usual principles and make individualised decisions in a pandemic setting.

108. A decision-making algorithm from the National Institute for Health and Care Excellence (NICE) was issued on 20 March 2020 under NICE's interim process and methods for developing rapid guidelines for Covid-19 [NICE, 2020, INQ000315780]. It was amended

within 48 hours after notice of a legal challenge from representatives of people with stable learning disabilities. Neither of the present authors were involved in developing the NICE algorithm, and the original draft is unavailable. The 22 March 2020 amendment clarified wording regarding frailty scoring (a tool intended for use in the over-65s) to ensure that people with stable learning disabilities were not disadvantaged [see paras 74.3-74.5]. Clinical guidance documents referenced the modified version of the above while it was extant. The revised NICE algorithm outlined the choices and outcomes that might be made but did not offer distinct criteria or thresholds. However, it prompted consideration of frailty as an element of holistic assessment in the over-65s [NICE, 2020, CG159 decision support algorithm, via web.archive.org]. The algorithm was part of broader written guidance that also emphasised the limitations of using the Clinical Frailty Scale as a sole assessment (NICE, 2020, CG159 archived version). The authors are unaware of any counterpart document for Wales, Scotland or Northern Ireland, but in general, NICE Covid-19 interim guidance was meant as an amalgamation of existing guidance to minimise duplication and could, therefore, be reasonably interpreted as a cross-border resource rather than an England-specific policy directive.

109. Unconnected with the above, on 21 March 2020, the Department of Health and Social Care (DHSC) convened a three-person expert working group, including one of the authors (Ganesh Suntharalingam) representing critical care, alongside Professor Sir Jonathan Montgomery, Professor of Healthcare Law at University College London, Chair of Oxford University Hospitals NHS Trust and Co-Chair of the DHSC Moral and Ethical Advisory Group (and, currently, Chair of the Infected Blood Inquiry Expert Group); and Professor (now Dame) Helen Stokes-Lampard, Professor of General Practitioner Education at the University of Birmingham and the former Chair of the Royal College of General Practitioners (Prof. Stokes-Lampard later took up post as Chair of the Academy of Medical Royal Colleges, which is now a Core Participant in the Inquiry under a subsequent Chair). The group was tasked to consider and develop a putative Covid-19 clinical prioritisation model to be used in the event of saturation of NHS critical care resources, drawing on insights and professional networks from primary care, critical care, ethics and law. It had an explicitly United Kingdom-wide remit and answered to the 'Quintet' of all four national Chief Medical Officers and the Medical Director of NHS England (Professor Sir Stephen Powis). The working group had an advisory and developmental role only, and implementation of any recommendations would have been by the decision of the Quintet, the CMO Office and Ministers.

110. A proposal was developed explicitly linking the concept of a clinical threshold with that of live, frontline-led stress reporting from ICUs and load-balancing between hospitals and regions via the existing Critical Care Readiness Condition (CRITCON) system (detailed above) to ensure that no premature prioritisation or localised iniquity of access ('postcode lottery') took place. The draft framework proposed that:

110.1 Usual individualised clinical decision-making would apply as long as any available critical care capacity remained (CRITCON 0-3). Putatively, clinical prioritisation, using thresholds outside usual practice, would occur only in the event of a centrally declared national resource emergency (CRITCON 4 in one or more regions/nations, with a high-level Governmental or NHS-wide declaration), and only after exhausting all possible sources of mutual aid between all hospitals.

110.2 Any notional clinical threshold would apply at the bedside only *in extremis* and after central (NHS/government-level) instruction, after stepwise escalation, including extensive expansion, transfer and use of all available resources, and only once critical care capacity had become exhausted nationally. In short, "No triage until every (accessible) ICU is full".

110.3 This assessment should be based on accurate collection and communication of realistic frontline ICU conditions using CRITCON or equivalent clinician-led measures rather than abstract bed counts against a theoretical bed base.

110.4 If critical care resources became exhausted nationally, any declared clinical prioritisation would operate on a ranking basis in the event of needing to prioritise one patient over another when competing for the same resource (in effect, "the last ICU bed").

110.5 Such a ranking would be based on the best available evidence regarding the probability that patients could be reasonably expected to survive and benefit. This criterion was not new and was drawn from pre-pandemic guidance on admission to and discharge from Intensive Care and High Dependency Units [Dept of Health, 1996].

110.6 Consistency would be encouraged through guidance on assessing objectively the probability of benefit. This would be refined as understanding of factors affecting Covid-19 survival improved, but such data were sparse in March 2020.

111. Anticipatory screening (in other words, using altered thresholds to decline patients for critical care even while capacity was still available) or reverse triage (transitioning a patient to end-of-life care earlier than would otherwise have occurred due to resource limitation reasons) were excluded from the brief, due to the complexity of such topics, the urgency and intensity already involved in finding objective, fair methodology even without them, and the need for even more extensive public engagement and consensus. In plain English, the working group was tasked to only look at the question of what to do and how to rank (not exclude) patients when and if the ICU beds ran out in the context of a national declaration of a state of emergency. It did not look at the possibility of turning patients away while beds were still available to keep space available for others, nor at the question of 'taking someone off a ventilator' to make room for others.

112. The proposal combined this with a clinical decision support aid for likely Covid-19 ICU outcomes, developed by a group of respiratory clinicians and intensivists early in the

pandemic, considering elements of age, frailty, and a shortlist of relevant co-morbidities. Importantly, the decision support aid was only for use within the overall guidance framework and only intended for ranking patients under CRITCON-4 conditions when centrally authorised. Under the proposed model, the decision-aid would have been iteratively updated and kept ready for potential use as the pandemic progressed; it was intended that this decision-aid would have incorporated validated data from emerging, evidence-based predictive tools.

113. The workstream drew on existing DHSC ethical principles for pandemic influenza planning [UK Government, 2017] and consulted with the critical care professional community, age and disability groups, and the DHSC Moral and Ethical Advisory Group at its meeting on 25 March 2020 [Moral and Ethical Advisory Group, 2020], as a result of which changes were made. This included the removal of numeric scoring in favour of narrative summary criteria and alterations about frailty assessment to ensure that people living with physical disability, learning disability and/or autism, sensory loss or mental ill health were not inadvertently disadvantaged and that the potentially demeaning or discriminatory, then-current Dalhousie University pictorial frailty graphics [Dalhousie University] were removed from the proposed draft.

114. The working group ran from 21 March 2020 to 28 March 2020. On 28 March 2020, Professor Montgomery, as the group Chair, was verbally informed by DHSC and the CMO that it was no longer anticipated that there would be insufficient critical care capacity and that no prioritisation guidance would be issued. It was agreed with Professor Whitty (CMO England/Chief Medical Advisor to the UK Government) that it might be appropriate for a professional society to publish an academic output from this work so that the learning from the discussions would not be lost. The Intensive Care Society, with discussion from wider stakeholders via the National Emergency Critical Care Committee, elected to progress this publication, which was published with all three members of the working group as co-authors (Montgomery, Suntharalingam, Lampard [Montgomery J et al., 2020]).

115. An early draft of the decision support aid, created for discussion within professional networks as invited by DHSC, was shared with the media by an unknown member of one of these networks, in unfinished form and in isolation from the intended broader framework. It contained draft elements, such as numeric scoring, that had already been removed from later versions at the time of being disclosed to the press. Publication of this early draft version did not affect the DHSC decision not to proceed with the ethical framework for NHS use, which had already taken place on 28 March. It also did not affect the decision to academically publish the final version of the framework as a whole, which was then felt to be all the more important: firstly, to place the decision support aid in its proper context, including CRITCON and all the 'no-one is full until everyone is full' steps needed before authorisation of clinical prioritisation by national authorities; and secondly to ensure that the final version and not merely an early draft was in the public domain.

116. The guidance document was first released in April 2020 – as a professional and academic publication rather than DHSC or NHS policy. It was released first as an Intensive Care Society Guidance document [Intensive Care Society, 2020], endorsed by the Royal College of Physicians (London), the Scottish Intensive Care Society, the Welsh Intensive Care Society, the All-Wales Trauma and Critical Care Network, the National Critical Care Networks of England, and Critical Care Network Northern Ireland. The DHSC was aware of this further work but was not its sponsor. It should be noted that some other organisations approached in April 2020 declined to formally endorse the guidance, namely the Faculty of Intensive Care Medicine, the Royal College of Emergency Medicine, the Association of Anaesthetists, the BMA and the GMC. We understand, however, that, of these latter bodies, the BMA felt guidance was essential and had called for DHSC/NHSE to publish effectively the same document in 2020.

117. The subsequent publication in August 2020 in the Journal of the Intensive Care Society [Montgomery J et al., 2020] is linked to as an external decision support resource in current NICE guidance [NICE 2021, CG191, Chapter 3.2], alongside guidance from the Royal College of Physicians, the GMC, the BMA and others.

118. This work was one of several discussions of approaches to prioritisation that opened a professional and public debate in the UK and beyond, which has transferable learning for future pandemics [Cardona M et al., 2021]. Although the concept of any clinical prioritisation is, on the face of it, unpalatable, there is potential benefit in open, safe, candid discussion and development of pathways, provided there is appropriate scrutiny, and it is done with publicly accountable oversight and involvement via the DHSC (and equivalents in the devolved administrations) and Chief Medical Officers. In this situation, it is vital that from the outset, there are clearly defined triggers for the application of prioritisation and clarity that it should not be used pre-emptively, which the guidance developed by the working group endeavoured to provide. When clinical staff are under tremendous pressure and resources are in danger of being overwhelmed, not only does the absence of guidance lead to loss of psychological safety and moral distress, but there is a risk that decision-making may happen spontaneously and inconsistently if they do not have the 'guardrails' of defined plans and a clear trigger for when to use them. In other words, in the opinion of the authors, transparent discussion and planning around prioritisation is itself the best safeguard against the inappropriate and incorrect use of triage, and (conversely) the greater risk is that triage may happen prematurely and under unregulated local pressure, as a direct result of not talking about triage.

119. At the time, careful consideration was given as to whether the decision to publish the decision-making framework might itself have created the risk of either the decision aid or other prioritisation methods being used to prevent clinically vulnerable patients from accessing treatment. .

119.1 Firstly, it should be emphasised that no decision was taken to publish a decision support tool as a stand-alone item. The decision support aid was

developed as part of a more comprehensive guidance framework based on systematic shared escalation and very clear indications of how and when it would be used, triggered, and under what national authorisation based on CRITCON (the "Nobody Is Full Until Everybody Is Full" principle).

119.2 Secondly, graphics that appeared in isolation in public media were not the complete guidance and decision support aid in its final form but a selective extract shared in isolation with a newspaper journalist by an unknown individual – who, if as is most likely, was a clinician with sight of the drafting and discussion process - would have been aware that it was not a complete or finalised draft and that premature release might be harmful.

119.3 Thirdly, the decision to publish the final guidance was separate, carefully considered and consulted on with organisational partners and followed a wide discussion of the work with representative groups of the clinically vulnerable (including older people and people with stable disability), as well as with the DHSC Moral and Ethical Advisory Group and professional bodies, including endorsement by those listed above. The publication came after the first wave of the pandemic and was intended expressly to allow broader professional and, ultimately, public discussion.

120. Based on these discussions, we would argue that having materials transparently in the public domain is the best protection. Our understanding is that there were (unsuccessful) legal challenges from advocates of people with stable disability over the decision *not* to publish guidance, due to a concern that such an absence might itself lead to unfair treatment by omission and without adequate oversight. This illustrates the complexity of this topic and the need for honest, ongoing public debate.

121. As a closing comment, although many bodies published general statements of principle and intent on this matter, none had hitherto provided specific guidance, and many clinical staff – at all levels, from decision-making senior staff to those at the bedside – felt, to a degree, vulnerable and lacking support regarding pandemic decision-making by the Government, the NHS, and the regulatory bodies (such as the GMC and NMC, which had otherwise been supportive over issues such as delegated care and working outside usual boundaries). Guidance from a professional society was necessary but not sufficient, and endorsement or alternative guidance from the direct healthcare chain of command, from the Government to employers and regulators, may have helped mitigate the moral injury and loss of confidence that arose.

Did intensive care processes differ in practice between pre-pandemic and Covid-19 conditions?

122. As discussed above, there are two aspects to this question. The first regards policy, and the second is human factors and the impact on individual decisions made under pressure. As

established above, the policy was to maintain usual intensive care processes and decision-making, dealing with local pressure overload by mutual aid and transferring patients between hospitals. A review of NHS England and NICE guidance (cited elsewhere) and sequential minutes of professional body collaborative meetings, including the Intensive Care Society-hosted National Emergency Critical Care Committee [Sidhu MS et al. 2022] [Intensive Care Society 2021], consistently show no operational or clinical policy change during the inquiry period. During periods of usual clinical practice, 'triage by resource' should not occur, and this continued to be the national, regional, and local policy throughout the pandemic and across all nations of the UK. In other words, if critical care capacity became limited at a given location, then the most appropriate clinical decision for the patient should still have been made, and if necessary, the patient transferred to another hospital with sufficient ICU capacity to admit them.

123. The second aspect relates to human factors and the inevitable complexities of thousands of staff making countless individual decisions daily during a pandemic, under unprecedented pressure. Critical care staff, including senior decision-makers, were working outside their usual patterns while overseeing teams of redeployed non-critical care specialist staff working in entirely new ways in the midst of rapidly changing clinical practice and understanding of the disease and constant fluctuations in equipment, oxygen, medicines, and protective equipment availability. A pandemic is arguably more complex than a single, even large, catastrophe in that the injuries and new cases do not stop in a defined timescale [Vincent J-L, Creteur J, 2020]. Under these circumstances, variations in decision-making and conscious or subconscious application of clinical thresholds are likely to have occurred through the sheer complexity of the circumstances. This needs to be understood, honestly acknowledged, and learned from, for the sake of the patients with Covid-19 and their families, but also for future planning and to ensure the moral distress and injury experienced by clinical staff is recognised and addressed. The impact of real-world decision-making under pressure is discussed further below in paragraphs 156-166 .

124. Potential variations in decision-making, to our minds, make a case for pre-emptive planning and identification of key moral, ethical and legal principles, with broad professional, patient and public involvement, in advance of a future pandemic – even though the medical details and predictive outcome factors of any new disease would need to be worked on afresh at the time. Even during the very short and high-intensity development period of the putative framework in March 2020, a significant range of representative groups were approached, including age and disability stakeholder groups. However, this was necessarily done at pace, and a more prolonged and broad 'peacetime' exercise, potentially taking the existing DHSC Moral and Ethical Advisory Group as a starting point or other methodologies, such as those described below, may enable better opportunities to involve a broad spectrum of voices. Such an open discussion requires an honest acceptance, at the outset, of the possibility that critical resources might become exhausted in some future scenario Such an outlook and starting point may be easier to achieve outside the operational pressures and (inevitably somewhat defensive) political environment of a current and ongoing pandemic.

125. The evidence is that the public has an appetite for such discussions. In an online survey by ethics expert researchers during the summer of 2020, 763 people from a pool selected from market research panels as being representative of the UK population were asked about hypothetical ethical dilemmas, which included refusing ICU admission for patients less likely to survive (and the factors that might go into this), as well as options bolder than any considered at the time, such as withdrawing ICU treatment to allow treatment for others, or even tossing a coin to decide between patients in the case of a narrow margin [Wilkinson D, Zohny H, Kappes A et al., 2020]. The conclusions were that representative members of the UK public may support a broadly utilitarian approach – in other words, to save as much life as possible under conditions where it is not possible to save everyone - and accept that difficult decisions may be necessary, which include taking into account patient factors and characteristics such as age, frailty and others not part of current debate (e.g. parenthood of young children). In other words, the public may be further 'ahead of the curve' on these topics than healthcare, ethics, and legal professionals might expect.

Care in the last days of life

126. Covid-19 was and remains a new and complex disease from which recovery is possible. There was thus, correctly, no indication or guidance on ending attempted lifesaving treatment and introducing palliative care (in other words, no dictated time limit on treatment), either on clinical grounds (as the outcome was uncertain) or on resource utilisation grounds (in other words, 'reverse triage'). Decisions on moving from intensive to palliative care were instead made by usual clinical judgement, based on an ongoing assessment of an individual's response to treatment, the trajectory of an individual's condition, the existence of co-morbidities, and other factors affecting the ability to recover, rather than by timelines or length of stay. In other words, clinical decisions were made based on observed progress or deterioration rather than according to a timeframe. International guidelines suggested that at least 10-12 days in ICU for would be needed to assess the potential for survival and recovery of critically ill adults with Covid-19, but with weak evidence – this did not constitute a maximum time or cut-off period for active treatment, and many people spent considerably longer than this in ICU. [Aziz S et al., 2020]

127. Broader discussions of palliative care at home, in the community, or in hospitals outside the ICU are outside the scope of this report and should be referred to palliative care experts.

How palliative care was provided to those with Covid-19 in ICU

128. Firstly, with respect to the published advice regarding palliative care for ICU patients specifically, NICE released guidance about the care of dying adults in 2015 [NICE NG31, 2015]. Subsequently, in 2019, the Faculty of Intensive Care Medicine released specific guidance on care at the end of life in ICU [Faculty of Intensive Care Medicine, 2019], recognising that 15-20% of people admitted to UK intensive care die in hospital and that

35% of adult hospital inpatients are in their last year of life. It emphasised the importance of individualised assessment of a patient's symptoms, needs and values, and of family involvement and clear communication. The document provided guidance on best practice and 'how', but not 'when' or 'if', the transition from lifesaving treatment to palliative care should occur, as the latter is a fundamental part of the patient's clinical trajectory and a matter for individualised expert judgement by the treating team. This approach continued to apply throughout the pandemic.

129. During the pandemic, best practice guidance from the Faculty of Intensive Care Medicine, NICE, and the British Geriatric Society was brought together [NICE Critical Care, 2020]. The Association for Palliative Medicine also issued guidance on palliative and end-of-life care in Covid-19 [Association for Palliative Medicine of Great Britain and Ireland, 2021]. This guidance covered symptom control, clinical decision-making, withdrawal of non-invasive ventilatory support outside ICU, and compassionate management of dying patients and their families in the context of visiting restrictions and telephone conversations. NHS England's guidance regarding the clinical management of critically ill adults with Covid-19, which was subsequently led by a joint working group (of which Professor Summers was a member) from the Royal College of Anaesthetists, the Faculty of Intensive Care Medicine, the Intensive Care Society, and the Association of Anaesthetists), continued to be updated throughout the pandemic, with end-of-life care recommendations aligned with those already cited [ICM Anaesthesia COVID-19, 2020].

130. In general, equipment and medication for palliation at the end of life, when indicated, would have been available in the ICU since the equipment and other elements needed (e.g. intravenous infusion devices and drugs to deliver sedation and other aspects of the care required) are already a routine part of ICU care. The scenario where a patient has been treated to the fullest extent possible but reaches a point where death is inevitable, is a necessarily common one in ICU regardless of the pandemic, and ICU staff are trained and familiar with the needs of patients, their loved ones and colleagues, in a palliative care situation. Although Covid-19 as a new disease process did not change this in principle, it brought significant new challenges with staffing dilution and delegated care, in conditions where families could not be present at the bedside, and where communication and compassionate care was made more difficult –under conditions of isolation and use of PPE. In addition, a not uncommon scenario was of patients who were not clinically appropriate for escalation to invasive mechanical ventilation reaching the last days of their lives while conscious and on non-invasive ventilation or high-flow nasal oxygen. Although this sometimes happens with patients reaching the end of life due to respiratory failure in non-Covid ICU care, and all ICUs have the means to make sure that the end of life - when unavoidable - is comfortable and dignified, the numbers of such cases, surrounding circumstances and staff dilution during the pandemic made this even more emotionally challenging for everyone involved, and contributed to moral injury and staff leaving ICU.

131. In feedback from Core Participants, the question of guidance and the consistency in implementation (for example) of visitor access to dying patients has been raised. We agree that this is an important topic, most obviously for the patients and imminently bereaved, and also for staff who were traumatised by not being able to care for the dying with their loved ones present. Although we have not seen the evidence cited, we accept the suggestion that individual experiences varied across organisations and areas, in that different organisations may have implemented or relaxed restrictions in different ways and at different stages. We are not aware of guidance or of monitoring data for this. It may be difficult to issue blanket NHS-wide instructions given the likely wide variation in circumstances in a complex system (different ICUs had different layouts and environments, conditions, patient numbers, and access, making compassionate, sensitive visiting more challenging to enable in some cases, but very feasible in others), and in an evolving state of variable external public health measures across regions and of potential risks to visitors themselves as the pandemic evolved. In general, we agree with the premise that earlier and more universal access for loved ones of patients in the last days of life might have been possible. Particularly later in the pandemic, contextual factors such as improving understanding of transmission, increasing use of critical care transfers and load-balancing between hospitals and regions (and thus perhaps less peak individual pressure in some units), and public vaccination could perhaps have enabled earlier of visiting restrictions. In future pandemics, some form of general guidance designed to be adapted to individual sites and a statement of principles that access to dying patients should be prioritised wherever possible could be used to minimise the harms of this measure. This is an important learning point.

Resources

Supporting information was provided by Prof Kevin Fong (UCL) and Prof Tim Cook (University of Bristol and Royal United Hospital Bath).

Staff well-being

132. ICU capacity was expanded to accommodate the increase in the rate and volume of arrival of critically ill patients produced by the Covid-19 pandemic surge. However, ICU staff faced a constellation of specific stressors, including the perceived and actual risk to their health from exposure to Covid-19, very high mortality rates among the patients in their care [Greenberg N et al., 2020], reduced staffing ratios, shortages of personal protective equipment, and the need to work beyond their level of seniority [Roberts T et al., 2020]. These, in turn, impacted the well-being and mental health of ICU staff negatively and severely. [Hall CE et al., 2022; Greenberg N et al., 2021]

133. During 2020 and 2021, NHS England supported a programme of peer-support visits to hospitals that were perceived to be under significant strain, to enable 'shop-floor'

intelligence gathering regarding the impact of the pandemic and any mitigations that might be helpful to short-circuit the escalation pathways and reach the central organisation in a relatively unfiltered manner. We understand that further information about these site visits is being sought by the Inquiry to provide context regarding the real-world experiences of ICU and other healthcare workers across NHS England. We are unaware of a similar programme taking place in Wales, Scotland or Northern Ireland, but the relatively smaller size of those nations may have led to the experiences of ICU staff reaching central decision-makers in the absence of such a programme.

134. The poor mental health of ICU staff has the potential to impact the quality and safety of patient care. The phenomenon of presenteeism, in which staff continue to work while functionally impaired by the state of their mental health, may lead to an increased risk of errors and poorer performance, which in turn may impact the quality and safety of patient care. [Salyers MP et al., 2017; Tawfik DS et al., 2019]

135. Safety critical, vigilance tasks are a core feature in the delivery of critical care, and thus, staff working in ICU settings must function at a high level to ensure the safety and quality of patient care. During the pandemic, data suggests that ICU staff experienced poor mental health as well as severe functional impairment. A cross-sectional study of intensive care units in England demonstrated high levels of reported mental health disorders, including extremely high levels of post-traumatic stress disorder (PTSD) and functional impairment [Hall CE et al. 2022]. These findings are broadly in keeping with other studies of healthcare workers' mental health during the pandemic [De Kock JH et al, 2021; Sahebi A et al, 2021; Wanigasooriya K et al, 2021].

136. The study analysed data from three time points to explore the impact of the Covid-19 surge on the mental well-being of staff working in ICUs [Hall CE, 2022]. Fifty-six hospitals in England participated, with 6,080 respondents across the time points. Data collection occurred in three time periods: before 19 November 2020, to 17 December 2020; from 26 January 2021 to 17 February 2021; and after 14 April 2021 to 24 May 2021. All ICUs surveyed exceeded 100% of their baseline capacity during the winter 2020/2021 surge.

137. Before the Covid-19 surge in January 2021, Covid-19 in November and December 2020, more than 50% of staff met or exceeded threshold criteria for at least one of the surveyed mental health disorders (depression, anxiety, harmful use of alcohol, post-traumatic stress disorder (PTSD). It is worth noting that ICUs were already under significant pressure even at this point.

138. During the peak of the highest Covid-19 surge in England, in January and February 2021, almost two-thirds of ICU staff included in this study met or exceeded the threshold criteria for at least one of the surveyed probable mental health disorders.

139. After the surge, in April and May 2021, the number of staff meeting or exceeding the threshold for any mental health disorder remained at more than 45%.

Functional impairment

140. The Work and Social Adjustment Scale (WSAS) scale is a recognised screening tool based on how much an individual's ability to carry out day-to-day tasks is impacted by an identified problem in their lives (e.g. '*Because of the way I feel my ability to work is impaired*'), and consists of five items answered on an 8-point Likert scale. A score of >20 indicates severe psychopathology-related functional impairment, and a score of >10 indicates moderate functional impairment [Mundt JC et al, 2002].

141. In the ICU healthcare worker study, mental health status was associated with functional impairment; with those experiencing probable moderate depression, moderate anxiety, or probable PTSD more likely to meet the threshold criteria for functional impairment. Functional impairment was more prevalent during the surge in comparison to after. During the surge, 69.1% (67.4–70.8%) of participants met the threshold criteria for functional impairment (consisting of 27.9% moderate and 41.2% severe). After the surge, 52.8% (50.8–54.7%) of participants met the threshold criteria for functional impairment (27.3% moderate and 25.5% severe).

142. Together, these findings suggest that the mental health of staff who worked in the ICU during the pandemic worsened as the rate and volume of admission of critically ill patients increased, with likely consequences for the quality and safety of patient care.

Post-traumatic stress disorder (PTSD)

143. The study included a self-report measure of PTSD symptoms, the PCL-6, and identified that a sizeable fraction of respondents met or exceeded the threshold for probable PTSD at all three time points. Whilst there are no robust pre-pandemic data from ICU staff against which to compare this finding, these rates of probable PTSD are comparable to that seen in British military veterans deployed in a combat role during the war in Afghanistan [Stevelink SA et al., 2018].

144. While this study took place in the intensive care unit setting, it is likely that these impacts are not limited to those staff who worked in the ICU during the pandemic, as suggested by studies broader in scope [De Kock JH et al, 2021; Sahebi A et al, 2021; Wanigasooriya K et al, 2021].

145. Communication with families was a significant challenge for a variety of unavoidable reasons, including hospital visiting restrictions, ICU infection control precautions, including the use of unit-wide cohorts in many cases, and difficulties communicating with PPE. As well as the effects on patients themselves, staff found it particularly distressing to be conveying prognostic uncertainty, bad news and bereavement by telephone, and in many cases through PPE, along with the absence of day-to-day contact and involvement with the loved ones of ICU patients, which is a usual and valued part of ICU care. This has undoubtedly been a major contributor to moral distress and psychological harm.

ICU capacity – staffing ratios and bed occupancy

146. We note with concern the evidence given to the Inquiry by Helen MacNamara, former Deputy Cabinet Secretary, in which she stated, "*...We kept being told that the NHS capacity was elastic.....It was only much later that I realised that what was meant by NHS capacity being elastic was the capacity of people working within the NHS to work themselves into the ground to keep people alive.*" [MacNamara H, 2023, (INQ00027384 1 _0089, paragraph 181)]. This and other indicators suggest there may have been a disconnect between the experience of healthcare workers on the frontline and the information understood by some senior decision-makers. This disconnect highlights the critical distinction between the availability of physical bed spaces and the delivery of ICU care, which is provided by a multidisciplinary team of specialist staff. Whilst physical bed spaces can be rapidly increased, the same is not true for specialist staff, who take years to train.

147. On 30 January 2020 (the day the WHO declared Covid-19 to be a public health emergency of international concern (PHEIC)), acute hospitals in England had 3,654 available ICU beds, of which 83.3% were occupied [NHS England, Winter SitRep 2019-20 Data]. It should be noted that only some of these beds were staffed and equipped to provide invasive mechanical ventilation. ICU beds are a mixture of Level 3 beds (resourced to provide invasive mechanical ventilation) and Level 2 beds (not resourced to provide invasive mechanical ventilation). It appears that some senior decision-makers and advisers may not have appreciated this nuance [Email from Dominic Cummings to Marc Warner and Tom Shinner, dated 25 March 2020; INQ000174715_0001].

148. Data from ICNARC (which covers almost all ICUs in England, Wales and Northern Ireland) prepared in February 2020, reported that on 31 March 2019, 3,075 adult critical care beds were available in the hospitals they recorded data for (2,797 in England, 192 in Wales, and 86 in Northern Ireland). This equated to an overall provision of 5.0 beds per 100,000 population. According to the SICSAG (which covers all ICUs in Scotland) report provided to the Inquiry, in 2019, there were 252 ICU beds in Scotland, of which 189 were equipped to offer invasive mechanical ventilation [SICSAG 2024, INQ000479816 p.46].

149. Patients receiving invasive mechanical ventilation require one specialist critical care nurse for every patient [Faculty of Intensive Care Medicine and Intensive Care Society, 2022]. At the onset of the pandemic, with so few specialist ICU nursing staff and Covid-19 patient numbers multiplying rapidly, it was anticipated that this standard would not be met, and national guidance was issued that permitted this one-to-one ratio to be diluted as far as one specialist critical care nurse to six ventilated patients [NHS, 2020].

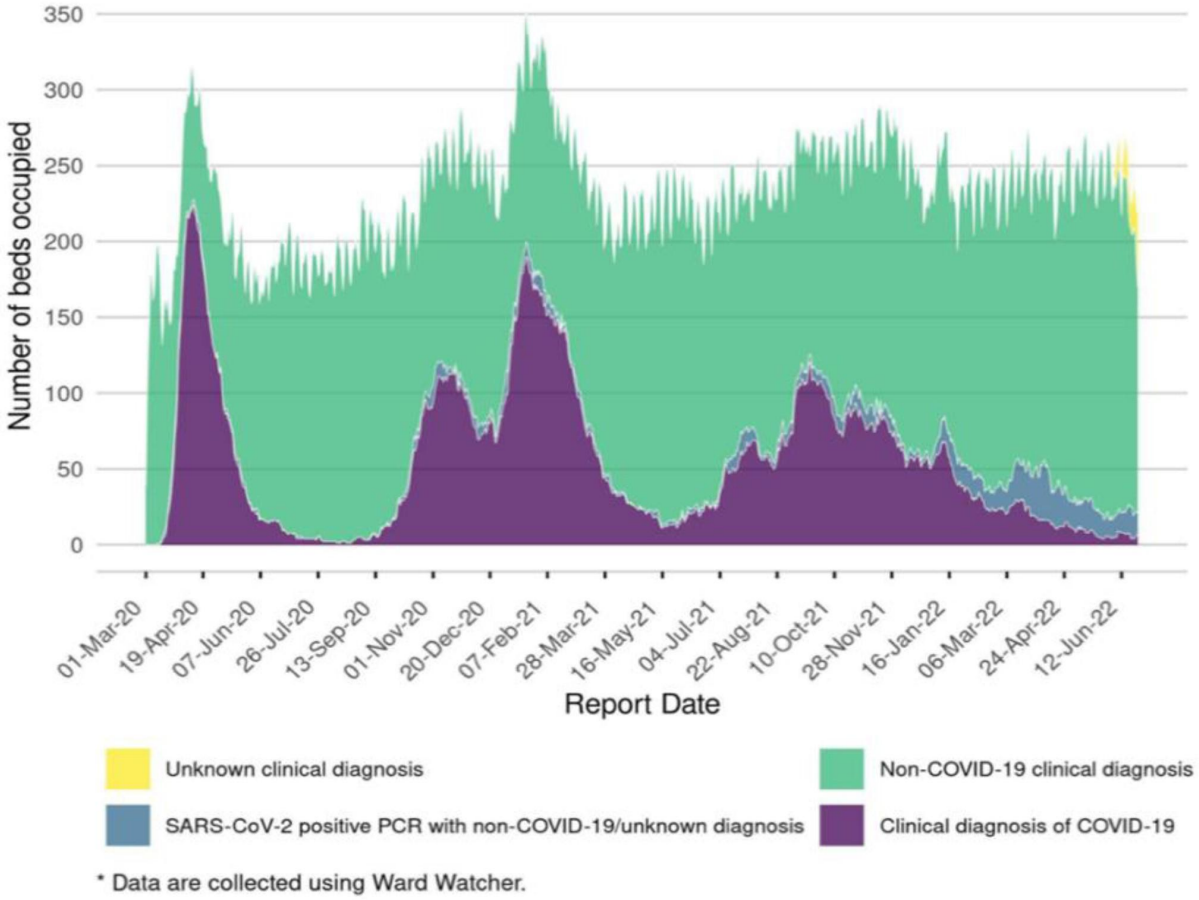
150. National nursing professional bodies, the Nursing and Midwifery Council (NMC), the Chief Nursing Officers of England, Scotland, Northern Ireland and Wales, and the Royal Colleges and nursing unions issued a joint statement on 25 March 2020 [UK Critical Care Nursing Alliance et al., 2020, INQ000227427] recognising that the pandemic surge required a fundamental shift from usual practice, and pledging support, guidance, and importantly, an

assurance that as the professional regulator, the NMC would take account of the conditions, resources, and current guidelines and protocols in place in the event of any concerns raised about the clinical practice of a Registered Nurse. The joint statement was an important contributor to psychological safety and confidence and was echoed in similar statements from other professional groups.

151. By mid-April 2020 (the peak of wave one ICU occupancy), there were 4,014 occupied 'mechanical ventilation beds' in England, of which 2,881 were occupied with patients with Covid-19 [NHS England Covid-19 Hospital Activity], which was below the newly expanded bed capacity. However, the headline data disguises a more complex reality. The first wave was rapid in onset and highly asymmetric, meaning that some hospitals and regions experienced extreme pressure to the point they significantly struggled. At the peak of the first surge, critically ill patients were presenting to hospital *in extremis* and transfer, particularly over long distances, was rarely practical for reasons of staffing and safety. The Nightingale facilities were initially proposed to expand available capacity, but ultimately proved impossible to staff and equip at scale and, crucially, were not suitable for managing complex patients with multiorgan failure. As a result, the hardest-pressed units during Spring 2020 were forced to operate at the newly approved, diluted staffing ratios and to accommodate the surge in intensive care patients in inadequately equipped 'pop-up' or 'surge' ICUs.

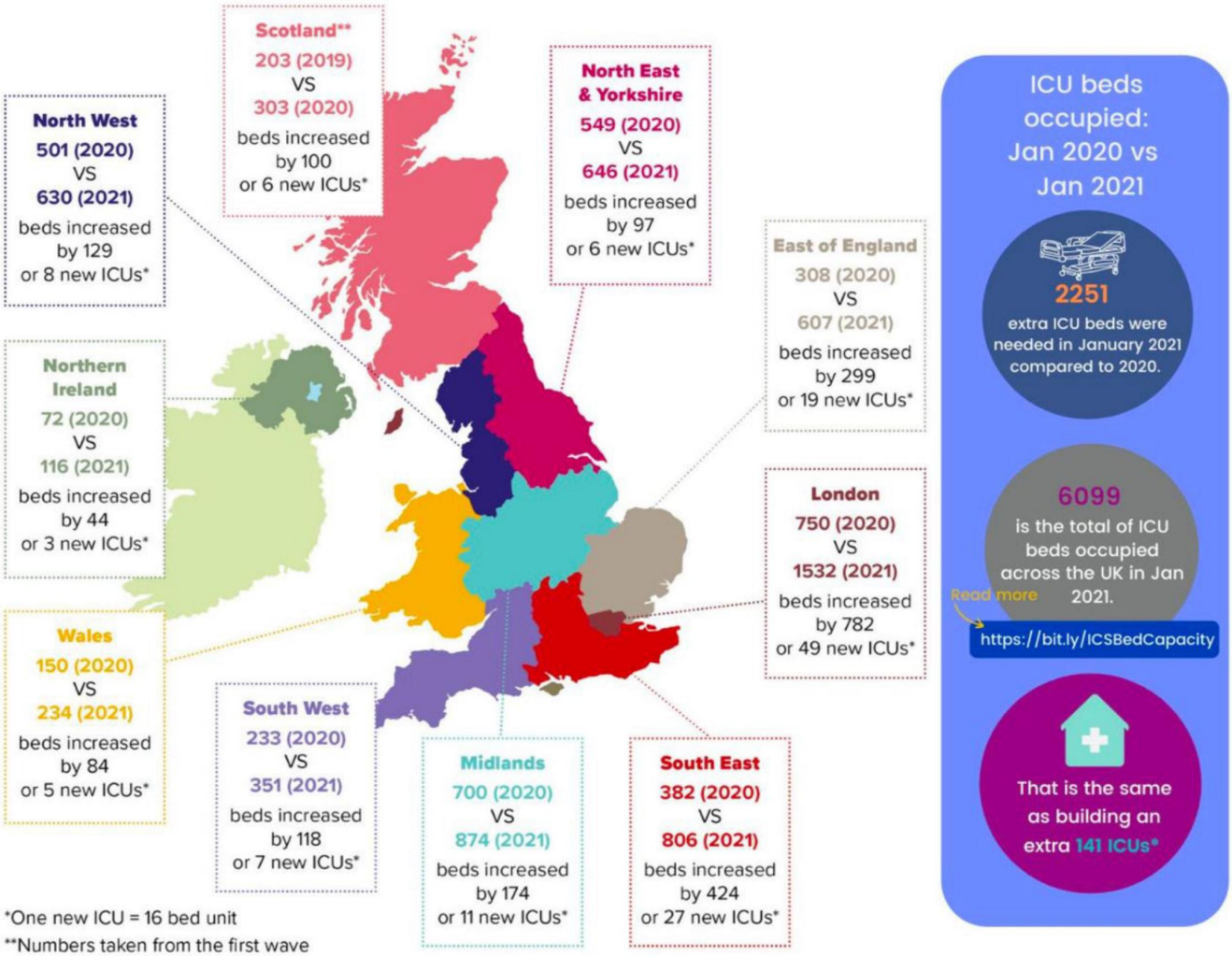
152. ICU bed occupancy in Scotland was mostly below the 252 beds present before the pandemic, and not all able to deliver invasive mechanical ventilation. However, there were three periods when this bed base was exceeded – Spring 2020, Winter 2020-21 and Autumn 2021.

Figure 10: Bed occupancy in Scottish ICUs over time (data from SICSAG). The total critical care bed provision in 2019 was 252.



153. The Covid-19 wave peaking in early 2021 was accompanied by a far larger surge in critically ill patients with, at peak, 5,509 of the available 6,305 ICU beds in England occupied [UEC, 2021] (with a combination of patients with and without Covid-19) on 23 January 2021. Modelling contained within the Intensive Care Society's Recovery and Restitution document [2021] estimated that in January 2021, there were 6,099 occupied ICU beds across the UK, which required a surge response equivalent to building an extra 141 ICUs.

Figure 11: Regional increases in occupied ICU beds above baseline levels. Source: Intensive Care Society - Recovery and Restitution of Critical Care Services during the Covid-19 Pandemic (2021)



154. Their report also provided indicative data regarding the impact of the January 2021 wave on ICU staffing ratios:

One member of staff cares for..	Number of Patients Jan 2020	Number of Patients Jan 2021
Consultant	12	16 - 33
Nursing	1	1 - 3
Junior Doctor	8	12 - 23
Pharmacist	10	13 - 26
Physiotherapist	4	8 - 15
Dietitian	10	14 - 27
Speech & Language	10	39 - 76
Occupational Therapist	10	84 - 162
Psychologist	10	69 - 134

These numbers take into account pre-existing staff vacancies and 10% sickness.

155. We note the statement provided to the Inquiry by Helen MacNamara, Deputy Cabinet Secretary, states regarding winter 2020-21, *"...when we finally got a meeting with Simon Stevens and the Prime Minister to talk about how the NHS was coping under the strain and what would happen next we found out in the meeting that the situation was worse than had been reported. The v-bed (ventilator bed) capacity was breached 11 January 2021..."* [INQ000273841_0089 paragraph 182]. Neither of this report's authors is aware of V-bed capacity (combination of baseline and surge capacity) being breached in January 2021. In our view, Ms MacNamara's statement provides further evidence of the communication disconnect between frontline clinicians and senior decision-makers.

Signals of changes to clinical decision-making about escalation to ICU

156. The policy approach to a scenario where critical care resources are overwhelmed is discussed in paragraphs 107-121. Unfortunately, it is likely that in practice, ICU capacity was overwhelmed in some individual locations at certain times and that the criteria for ICU admission changed via local informal processes (conscious or unconscious alterations in decision-making by individual clinicians rather than due to policies or guidelines being issued) when capacity was stretched, meaning those who might usually be admitted to ICU were not. This is a contentious topic for which robust data are challenging to assemble.

157. One consequence of not admitting patients to the ICU who would hitherto have been managed in the ICU involved the delivery of ICU services in hospital wards. Examples that

occurred include the delivery of high-intensity care, such as continuous positive pressure ventilation (CPAP) and high flow nasal oxygen (HFNO) in hospital wards that would not do so outside of the pandemic [Thygesen JH et al., 2022]. This effectively increased the number of patients receiving 'critical care' in the hospital. Still, as it was delivered outside the ICU, it was not systematically captured in measures of 'ICU admissions' such as those collated by ICNARC. Therefore, the data underestimates the overall number of critically ill patients. The extent to which such care was delivered outside the ICU likely varied between hospitals and over time. It is likely that in some hospitals, half of the patients receiving this level of support were outside the ICU.

158. The second way to manage capacity is to reduce admissions by altering admission criteria. There are few data to substantiate what may be considered normal variations in practice arising from clinician judgement - when a patient is reviewed on a ward and is considered for admission to critical care, there may be a softening or hardening of the willingness to admit when an ICU is very quiet or particularly busy, respectively. This differs from directed or planned changes in admission criteria, which would amount to triage.

159. Several signals suggest an alteration in the case mix of those admitted to ICU early in the Covid-19 pandemic.

160. Firstly, ICNARC's routinely collected data shows a fall in admissions due to myocardial infarction and stroke of up to 60% in March-April 2020 [ICNARC 23 June 2023]. Trauma and self-harm admissions also fell during this period. These observed changes may be related to alterations in personal or national behaviours. Indeed, there is data reporting a substantial reduction in the number of patients with acute coronary syndromes (often termed "heart attacks") admitted to hospitals in England by the end of March 2020 (compared with the same period in 2019) [Mafham MM et al., 2020]. The admissions decrease had mostly reversed by the end of May 2020. The publication's authors conclude that the "*...reduced number of admissions during this period is likely to have resulted in increases in out-of-hospital deaths and long-term complications of myocardial infarction and missed opportunities to offer secondary prevention treatment for patients with coronary heart disease...*".

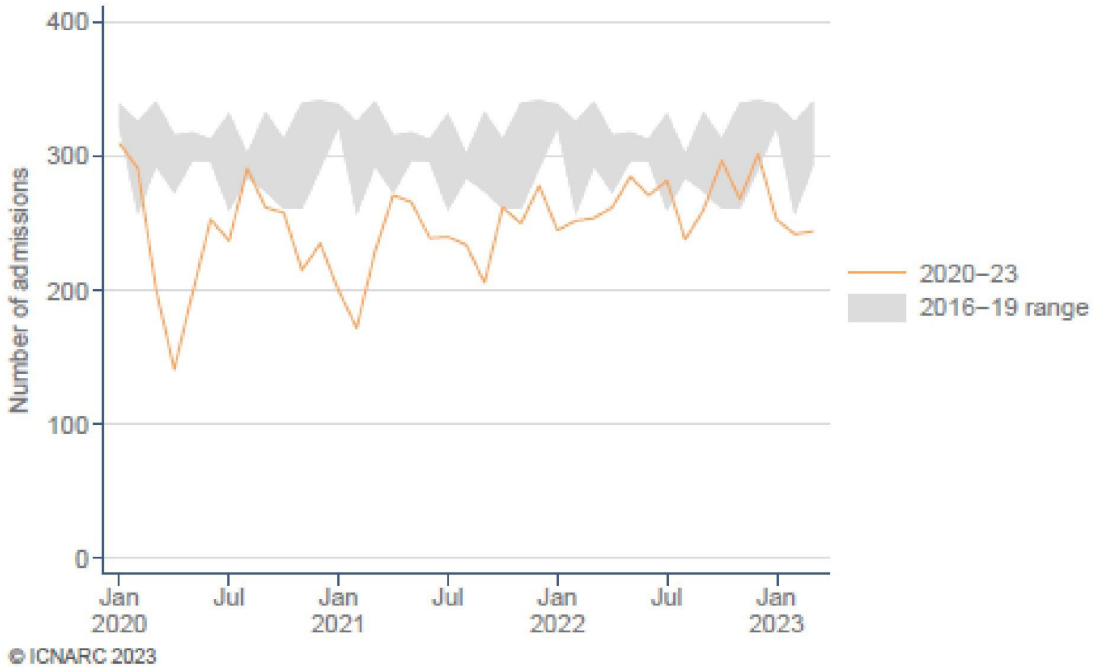


Figure 12a: Number of admissions with acute myocardial infarction by month, 2016-2023*

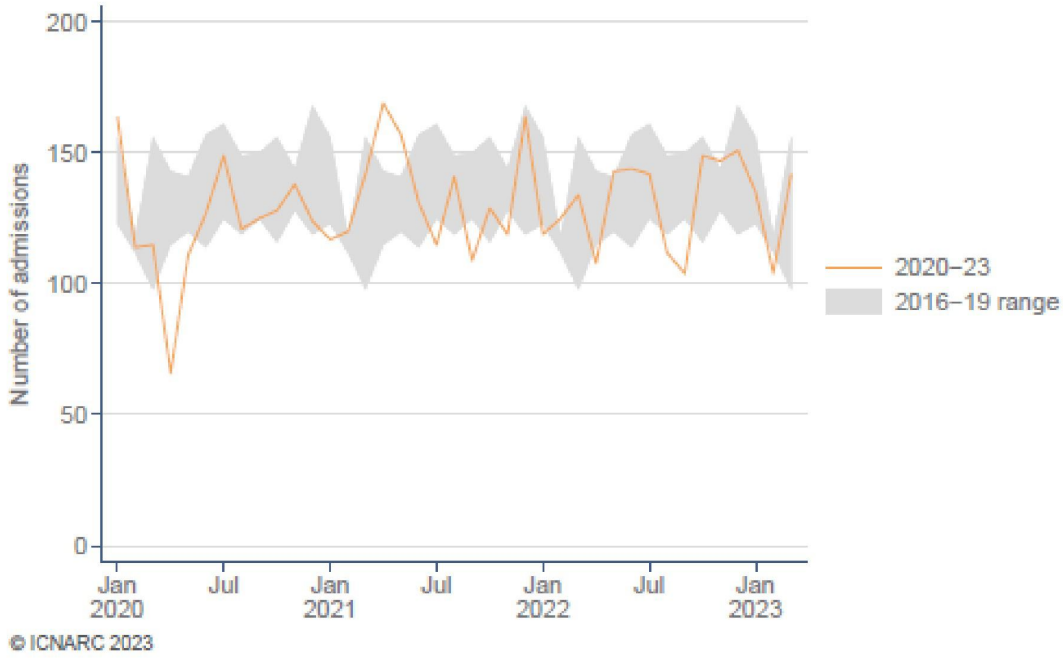


Figure 12b: Number of admissions with stroke by month, 2016-2023*

*Please note that data for patients without Covid-19 are submitted by participating critical care units either monthly or quarterly. Values have been adjusted for coverage. Data for patients without Covid-19 are from adult general critical care units only.

161. Second, a publication from ICNARC [Doidge JC et al., 2020] examined admissions to ICU during the first wave, which peaked in the last week of March and the first of April 2020.

During this period, patients admitted to ICU were '*younger and less severely ill... when compared to those admitted pre- and post-peak periods*'. Patients were also '*more likely to have acute kidney injury and to have more severe respiratory failure*'. The older and sicker patients will not have disappeared during that time, but fewer will have been admitted to ICU. The paper states, "*The proportions of patients aged >75 years or with any prior dependency was lower during the peak period. The proportion of patients with APACHE II scores >18 decreased during the peak period despite a long-term increasing trend, and the proportions with PaO2 /FIO2 ratio <200 mmHg or Kidney Disease: Improving Global Outcomes stage 2 or stage 3 kidney injury increased during the peak period despite long-term downwards trends.*".

162. The data from Doidge JC et al raise the possibility that efforts were directed at saving patients with the greatest chance of survival (those who were younger and previously fitter but with the most severe illness) during the peak of the first wave. At the same time, London - which was most affected by the first surge peak - showed an increase in hospital mortality, with this being lower either side of the period of peak admissions: "*Although the overall trend in 8-day in-hospital mortality was decreasing, when London (with the highest critical care admission rate) was compared with non-London (all other regions combined), an n-shaped curve was observed for London but the confidence intervals for London/non-London overlapped*" (i.e. these changes were not statistically significant).

163. The authors further state, "*Deviations in some trends were apparent during the peak period. Patients admitted during the peak period were slightly younger (less likely to be aged >75 years), less likely to have any prior dependency, and more likely to have moderate or severe respiratory dysfunction or renal dysfunction, despite overall downward trends for these during the first wave of the epidemic. Processes of care in ICUs, however, did not deviate, and mortality only slightly improved during the peak period. Examining London, the region with the highest burden of Covid-19 admissions, there was some indication (nonsignificant) of an increase in the adjusted 28-day in-hospital mortality during the peak period. Taken together, these observations might suggest conservation of ICU resources (i.e., caring for less severe critically ill patients outside of the ICU) and/or rationing of care during the peak period.*"

164. Finally, an analysis from ISARIC [ISARIC Clinical Characterisation Group, 2021] tracked the longitudinal clinical paths of 142,540 patients (most of which were from the four nations) with Covid-19 admitted to hospitals between March and December 2020. A key finding was that the likelihood of a patient being in ICU three or seven days after admission varied by month. ICU admission was more likely in periods between surges than during surges, and this affected the elderly more than the young. In these groups, ICU admission was more likely in June and August than in April or October 2020. This would not be of relevance if the case fatality rate were stable, but ward mortality was highest when older patients were least likely to be admitted into ICU, suggesting these patients may potentially have benefitted from ICU admission.

The peak of the second wave - December 2020 to February 2021:

165. While much discussion focuses on the events, decision making and ICU capacity during Spring 2020, the Covid-19 wave from December 2020 to February 2021 brought a larger surge and many more patients than in Spring 2020. During this period, far more patients received advanced respiratory therapies (CPAP and HFNO) outside ICU and were cared for by acute medical teams with even fewer staff than were available in overflowing ICUs. In hospitals without sufficient infrastructure, this made existing ICUs even more pressured to take more Level 2 patients than in the first wave, as well as starting to do more elective work again. In some organisations, specialists from all the teams pulled together, but in others, ICU staff came under significant pressure from both emergency Covid-19 requirements on the one hand and, on the other, elective surgical teams, some of whom did not fully grasp the conflicting demands on ICU and HDU.

166. A particular feature of this phase of the pandemic was the transfer of critically ill patients from one hospital, which on that day was under extreme pressure, to another where there was available ICU capacity. This sometimes involved moving far across the country to a safer location for care. This served two purposes: first, it enabled the patient who was transferred to receive care in a less overburdened location (albeit with the risk of the transfer while critically ill), and second, it reduced the degree of overcrowding in the hospital from which the patient was transferred, potentially improving the quality of care that could be delivered there. With entire regions operating above their expanded capacity, the transfer of ICU patients became necessary at scale and over large distances, despite the risks. Transferring patients to create capacity is a surrogate marker of stress in the system; no such transfers are necessary when there is capacity. Before the pandemic, from December 2019 to February 2020, only 68 critical care capacity transfers took place (further detail on critical care transfer is outlined above in paragraphs 75-98). Between December 2020 and February 2021, 2,152 were necessary [NHS England Critical Care Capacity and Urgent Operations Cancelled 2019-20 Data]. These transfers were predominantly undertaken by newly commissioned critical care transfer teams [NHS England Adult Critical Care Transfer Service Specification, 2021].

Respiratory support equipment

167. There was a well-documented shortage of mechanical ventilators, both invasive and non-invasive, during the early stages of the Covid-19 pandemic. In February 2020, there was no central data on the number of available ventilators, as purchasing was usually devolved to individual NHS Trusts. NHS England & Improvement (NHSE&I, later renamed NHS England) put out a request to all Trusts in late February, which revealed that despite NHS staff working to source all available devices with the capacity to provide mechanical ventilation, only 7,357 devices were available, which included paediatric devices and devices that would not usually be used to treat hospital in-patients, for example, the ventilators usually used in ambulances. At this point, government modelling suggested that 59,000 mechanical

ventilators may be needed, so they became concerned that there was a risk of more patients requiring ventilatory support than devices available to deliver such support [Public Accounts Committee, 2020].

168. Two workstreams were launched in an attempt to minimise this risk. Firstly, in March 2020, the Department of Health and Social Care (DHSC) began purchasing ventilators on the global market as part of a wider DHSC and NHSE&I oxygen and ventilator programme. Secondly, on 16 March 2020, the Prime Minister launched the UK Government Ventilator Challenge, overseen by the Cabinet Office [Cabinet Office, 2020]. In late March, and again in April 2020, the estimate of the number of ventilators was revised downwards as a consequence of the modelling now taking account of the non-pharmacological interventions instituted and improved understanding of Covid-19.

169. In September 2020, the National Audit Office published a report of their investigation into how the government increased the number of ventilators available to the NHS in response to Covid-19. The report was part of a review of both workstreams [National Audit Office, 2020]. The investigation concluded that the programmes secured ~26,000 devices at a combined cost of £569 million across the two programmes, which was higher than expected in normal times.

"However, both departments maintained sufficient record of their programmes' rationale, the key spending decisions they took and the information they had to base those on. They also put in place effective programme management, controlled costs where they could and recovered some of their committed spending once it became apparent that fewer ventilators were needed than they had originally believed."

170. The ventilator programme was also reviewed by the UK Parliament Public Accounts Committee who, in November 2020, published their report [Public Accounts Committee, UK Parliament, 2020] and concluded:

> The government "*lost a crucial month because they were underprepared and reacted slowly to the shortage of mechanical venti*lators".
>
> "*It is not clear how the Department of Health and Social Care is assessing whether the NHS has enough critical care equipment for future dem*and."
>
> "*Despite having to operate at speed, the Department of Health and Social Care still had a duty to carry out full due diligence for all parts of the supply chain."*
>
> "*The ventilator challenge was an exceptional and far from traditional approach that offers some lessons for future programmes although they could not be applied wholesale under normal circumstances."*
>
> "*Both programmes succeeded in part due to cross-government working and the expertise of key individuals involved.*"

"The ventilator challenge produced intellectual property that should be exploited to maximise value for the taxpayer."

171. At the bedside, particularly in Spring 2020, clinical staff were required to use mechanical ventilators that were not designed for the invasive mechanical ventilation of critically ill adults (e.g. use of operating theatre anaesthetic machines that were designed to provide only a few hours of mechanical ventilation at a time, not days/weeks, and have very different technical requirements than usual ICU ventilators). In early April 2020, the extent of the need to use anaesthetic machines was recognised such that the Medicines and Healthcare Products Regulatory Agency (MHRA) published a Medical Devices Alert to highlight the considerations that needed to be taken into account when using anaesthesia machines 'off-label' during the treatment of critically ill patients [Medicines and Healthcare products Regulatory Agency, 2020].

172. Later in the pandemic, as devices purchased during the DHSC ventilator workstream became available, ICU staff encountered unfamiliar devices that did not provide all the features usually present in UK ICUs. This required the rapid training of ICU staff in using various models of ventilators at a time when clinical workloads were already increased, resulting in increased clinical risk to patients, strain on healthcare staff and operational challenges. It should be noted that NHS England provided useful bespoke educational materials to support clinicians in learning to use unfamiliar equipment. Whilst the shortages of familiar equipment issues were unavoidable at the time, they arose due to inadequate national and local planning before the pandemic.

Oxygen

173. One of the most essential treatments required for the treatment of both hospitalised and critically ill people with Covid-19 was oxygen. Supporting many patients with acute respiratory failure simultaneously in hospitals where the building infrastructure, and hence oxygen delivery systems (pipes and vacuum-insulated evaporators (VIE)) had not been installed with such demand in mind was challenging and led to multiple incidents and near misses.

174. Anecdotally, access to building plans with details of piped gas and other infrastructure was challenging at many sites, relying on record retention in Estates departments or access to past contractors for knowledge and documentation. We recommend a DHSC requirement for all Trusts and Health Boards to maintain current and easily accessible technical schematics of all facilities, including but not limited to oxygen and other gas delivery systems, power systems and their backup supplies, waste management systems, and environment ventilation.

175. On 1 April 2020, an alert was distributed via the Central Alerting System highlighting the threat to oxygen availability at sites [CAS Alert NHSE/I-2020/001 - INQ000443868], partly

due to the increased use of devices such as CPAP and invasive mechanical ventilation that use large quantities of oxygen.

176. On 4 April 2020, Watford General Hospital (West Hertfordshire Teaching Hospitals NHS Trust) declared a critical incident due to issues with their oxygen supply, which required them to transfer a small number of patients to other hospitals in the East of England and to ask people not to attend the hospital unless absolutely necessary. At a similar point in Spring 2020, multiple other hospitals were reportedly experiencing difficulties with their oxygen supply [Campbell D, 2020]. We have not been able to identify any cases documented in publicly available sources of patient harm caused by oxygen supply issues. However, these events were, at best, serious near-misses and will have exposed the patients, who required urgent transfer to other hospitals, to avoidable risk. Similar issues were again reported in the winter of 2020-21 [Campbell D, 2021].

177. One mitigating strategy to conserve oxygen was encouraging clinical teams to undertake good oxygen stewardship – ensuring that patients received only the amount required for their clinical condition. Whilst it is often presumed that more supplemental oxygen is a good thing, or at least not harmful, this is not the case, and careful administration of this therapy is essential. Prescribing target peripheral oxygen saturations to be achieved by the provision of supplemental oxygen for individual patients is good clinical practice. Modified (reduced) peripheral oxygen saturation targets were proposed in various guidance as outlined in the British Thoracic Society guidance regarding the "Respiratory Support of Patients on Medical Wards" published on 16 April 2020 [Walker G, 2020]. There is no evidence that the reduced targets are likely to have caused harm to patients, and they may have saved lives by ensuring oxygen was available to those who needed it.

178. Whilst the lower target oxygen saturations themselves may not have been harmful, there is concern that the equipment used to measure peripheral oxygen saturations may not be reliable due to some devices in widespread clinical use over-estimating the peripheral oxygen saturation in people with darker skin tones [Martin D et al., 2024], thereby exposing them to unrecognised lower oxygen saturations. Given the importance of the potential structural inequity caused by some medical equipment, urgent further attention is required from regulatory bodies such as MHRA (to review the approval of inadequate devices), research funders (to progress further evidence generation), and care providers (to ensure care is not impacted by inadequate devices being used at the bedside) to address this matter. Whilst we understand that the impact of this systematic bias remains not fully clear and is the subject of ongoing research, we strongly recommend that interventions to mitigate this issue are instituted as soon as actionable evidence becomes available to prevent further avoidable harm.

Renal support equipment

Supporting information was provided by Dr. Graham Lipkin, Chair, UK Kidney Care; Dr. Jon Murray, Consultant Nephrologist, South Tees Hospitals NHS Trust; Dr. Paul Cockwell, University Hospitals Birmingham NHS Foundation Trust.

179. Covid-19 is a multisystem disease with a very high incidence of acute kidney injury. For example, the ICNARC report from July 2021 indicated that 19.5% of ICU patients with Covid-19 required artificial kidney support [ICNARC, 2021]. The key lessons that arose during the pandemic included [Nadim MK et al., 2020]:

    179.1 Equipment and consumables relating to renal replacement therapy (a generic term encompassing haemofiltration in ICU and various forms of dialysis) presented a significant risk of life-threatening resource depletion, due to both increased demand [Mahase E, 2020] and reliance on offshore supplies from countries with their own needs. Although a less intuitive hazard than a lack of ventilators, any failure to provide artificial renal support to a patient in need is ultimately just as dangerous. Just as ventilators need oxygen, power, and consumables such as tubing and air filters, patients whose kidneys have temporarily or permanently failed, or who were already on dialysis before their hospital admission, are critically dependent on not only the renal replacement machine but all the dedicated fluids and material consumables that it needs to operate, making this an equally vital issue.

    179.2 The critical importance of prevention. Early attempts to minimise respiratory complications of Covid-19 through fluid restriction proved ineffective for survival and increased acute kidney injury. This was rapidly reversed through the shared dissemination of early clinical findings [Intensive Care Society, 2020] identifying a higher than expected rate of acute kidney injury and tying it to early adoption of a 'dry lung' strategy based on non-Covid-19 disease. The updated recommendations based on these findings were to adopt a more fluid-neutral strategy along with an evolving ventilator management strategy [Montgomery H et al, 2020].

    179.3 Such early findings and an ongoing live exchange of clinical views were rapidly disseminated through professional networks jointly coordinated by the Intensive Care Society and Faculty of Intensive Care Medicine, reaching 257 ICUs in the UK [Intensive Care Society, 2021], as well as a joint four-organisation website together with the Association of Anaesthetists and the Royal College of Anaesthesia [ICM Anaesthesia COVID-19, 2020]. During 2020, practice and clinical evidence continued to evolve, resulting in fewer patients receiving invasive mechanical ventilation and a simultaneous fall in the proportion of patients needing kidney support. It is unclear if this was cause and effect or due to parallel changes in clinical management [Doidge et al. 2020].

179.4 Vulnerable supply lines of consumables and fluids for continuous veno-venous haemofiltration (the primary form of renal replacement therapy used in ICU) highlighted the need for a robust supply chain and stockpile management.

179.5 It was important to ensure continued, non-discriminatory access to ICU, with high-quality outcomes, for patients with pre-existing end-stage kidney disease, including those already participating in dialysis programmes.

179.6 Alternative technologies were used in some ICUs (peritoneal dialysis, home dialysis equipment, intermittent haemodialysis), adapted for inpatient use with portable reverse osmosis or urgent re-engineering of hospital infrastructure.. Variation between sites was primarily a function of clinical need, local innovation and access to the necessary equipment and infrastructure adaptations. These changes required urgent training of healthcare staff to use new devices/technologies at times of increased clinical burden.

179.7 Other mitigations and adaptations included high-intensity, shorter-duration renal replacement to support more patients in a day using available supplies. This does not address limited consumables.

179.8 In common with other aspects of the Covid-19 response, a high level of professional networking and collaboration between and within specialities and sites became necessary at the regional level (Critical Care and Renal Operational Delivery Networks) and UK-wide (UK Kidney Association, British Renal Society, and Intensive Care Society), with outputs including shared guidance capturing pandemic learning [UK Kidney Association, 2020].

Medicines shortages

180. At various points from March 2020 onwards and throughout all waves of the pandemic and beyond, the availability of medicines used in the treatment of critically ill adults, those with Covid-19, and for the provision of general anaesthesia, were impacted by shortages. The Royal College of Anaesthetists, Association of Anaesthetists, Faculty of Intensive Care Medicine, Intensive Care Society and UK Clinical Pharmacy Association worked closely with the Chief Pharmaceutical Officer at NHS England to publish clinical guidance to assist in the mitigation of this impact [for example, Association of Anaesthetists and the Royal College of Anaesthetists, 17 April 2020]. ICU specialist pharmacists and pharmacy technicians were critical to the pandemic response in supporting teams to manage to source alternative agents and minimise the impact of the shortage on the provision of clinical care. The Royal Pharmaceutical Society worked with the UK Clinical Pharmacy Association to provide a training resource for non-critical care pharmacists who were redeployed to ICUs during the pandemic.

181. Shortages in medications, including those used to induce and maintain general anaesthesia or sedation in both operating theatres and intensive care units (e.g. propofol) and neuromuscular blocking agents were experienced multiple times throughout the various pandemic waves, and supply disruption alerts were circulated via the Central Alerting System [MHRA, 2020]. Guidance on adaptations to standard UK critical care medicine prescribing practice during pandemic emergency pressures was issued jointly by the Faculty of Intensive Care Medicine, the Intensive Care Society, the Association of Anaesthetists and the Royal College of Anaesthetists [The Faculty of Intensive Care Medicine et al., 2020] to assist ICU staff in safely caring for critically ill patients during times of supply disruption.

Availability of ICU staff and beds for patients requiring post-operative care and for those being treated for non-Covid-19 conditions

182. The impact of the pandemic on the availability of ICU staff and beds for people requiring post-operative care and those being treated for non-Covid-19 conditions was profound and is best demonstrated for surgery and anaesthesia by the ACCC-Track serial service evaluation [National Audit Projects, 2021]. The findings have been summarised in the academic journal Anaesthesia [Kursumovic E et al., 2021].

183. The survey was sent to all NHS hospitals where surgery is undertaken and circulated in three rounds (throughout the whole month of October 2020, 1-18 December 2020, and 18-31 January 2021). The denominator used to calculate the response rate was the 420 NHS hospitals where there was known to be the provision of anaesthetic services. Responses were received from 65% of hospitals in Round 1, 54% in Round 2, and 51% in Round 3.

184. In Round 3 (January 2021), 53% of respondents reported that Covid-19 pressures substantially prevented them from providing anaesthetic services, 38% described anaesthetic care as hampered, and only 9% were able to provide close to normal services. At this point in the pandemic, over 2,000 anaesthetists were unavailable for work in operating theatres, with 75% redeployed to ICUs and 42% of UK NHS operating theatres closed for surgery, and in many repurposed and fully occupied as makeshift ICU spaces.

185. Those remaining active only achieved half their usual throughput. Routine adult non-cancer surgery occurred at 33% of pre-pandemic levels, cancer surgery at 61% (43% in one region), and paediatric surgery at 32% (12% in one region). Overall, surgical activity was reduced to 46% of pre-pandemic levels, a loss of close to 10,000 operations every day.

186. The ACCC-Track survey studied stress and organisational disruption in UK hospitals, focusing on anaesthetic departments and ICUs. Anaesthetists are critical to the ICU as, in most hospitals, they comprise the majority of ICU medical staff. The four bodies comprising the ICM-Anaesthesia Covid hub [ICM Anaesthesia COVID-19, 2020 are the Association of Anaesthetists, the Royal College of Anaesthetists, the Faculty of Intensive Care Medicine and the Intensive Care Society. They defined the measures of stress on both anaesthetic/surgical services and ICU services [Restarting Planned Surgery in the Context of

the Covid-19 Pandemic: A Strategy document from the Royal College of Anaesthetists, Association of Anaesthetists, Intensive Care Society and Faculty of Intensive Care Medicine, 2020; Anaesthesia and Critical Care: Guidance for Clinical Directors on preparations for a possible second surge in Covid-19: A strategy document from the Royal College of Anaesthetists, Association of Anaesthetists, Intensive Care Society and Faculty of Intensive Care Medicine, 2020]. These are shown below but are colour-coded to show increasing stress and inability to perform basic services. The ACCC-track survey took place on three occasions, with the third being the most relevant, as it was during the December 2020 to February 2021 surge.

187. The data shown were provided by Professor Tim Cook and represent data for ICUs by country and region, as well as for anaesthesia-surgery departments by region. More than half of hospitals could not provide routine anaesthesia/surgical services. Staff and space were consistently the most important rate-limiting factors. The graphs are reproduced from Appendix 1 of the supplementary materials of [Kursumovic E et al., 2021].

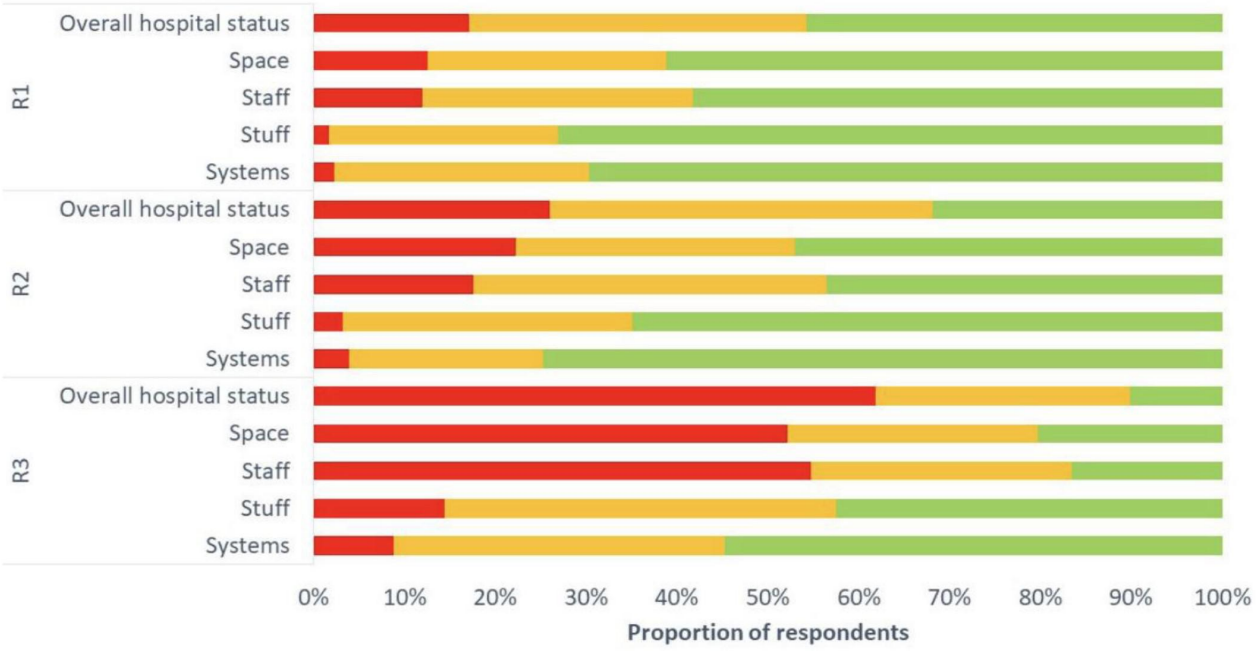


Figure 13: Proportion of respondents that reported their hospital was not able to resume planned surgery (red), nearly able to resume planned surgery (amber) or green (able to resume planned surgery (green) for 'Space, Staff, Stuff (equipment) and Systems' categories in October 2020 (R1), December 2020 (R2), and January 2021 (R3).

'Overall hospital status' indicates as red the proportion of respondents reporting at least one of the individual staff, space, stuff or systems measures as red; as amber the proportion with no red and at least one amber measure; and as green the proportion with all green measures. Source: Kursumovic E et al., 2021

188. The impact on surgical services is shown in the following figures. Many operating theatres were closed. The average proportion of theatres closed increased from 15% in October 2020 to 42% in January 2021. Regionally, the steepest rises in operating theatre closures were in London, the East of England, and South-East England regions, which all had among the lowest closure rates until 2021. Five regions (42%) had more than 50% of their normal theatre capacity closed, eight (67%) more than 40%, and ten (83%) more than 30%.

Figure 14: UK and regional variations of the average (mean) proportion of operating theatres closed compared with the same period the previous year, in October 2020 (blue bar), December 2020 (purple bar), and January 2021 (green bar) Source: Kursumovic E et al, 2021

189. This was partly mitigated by the use of external capacity – mostly in private hospitals - but in January 2021, this was not practical as staff were unavailable. The overall use of external sites to maintain surgical activity decreased from 10% in Autumn 2020 to 8% in early 2021.

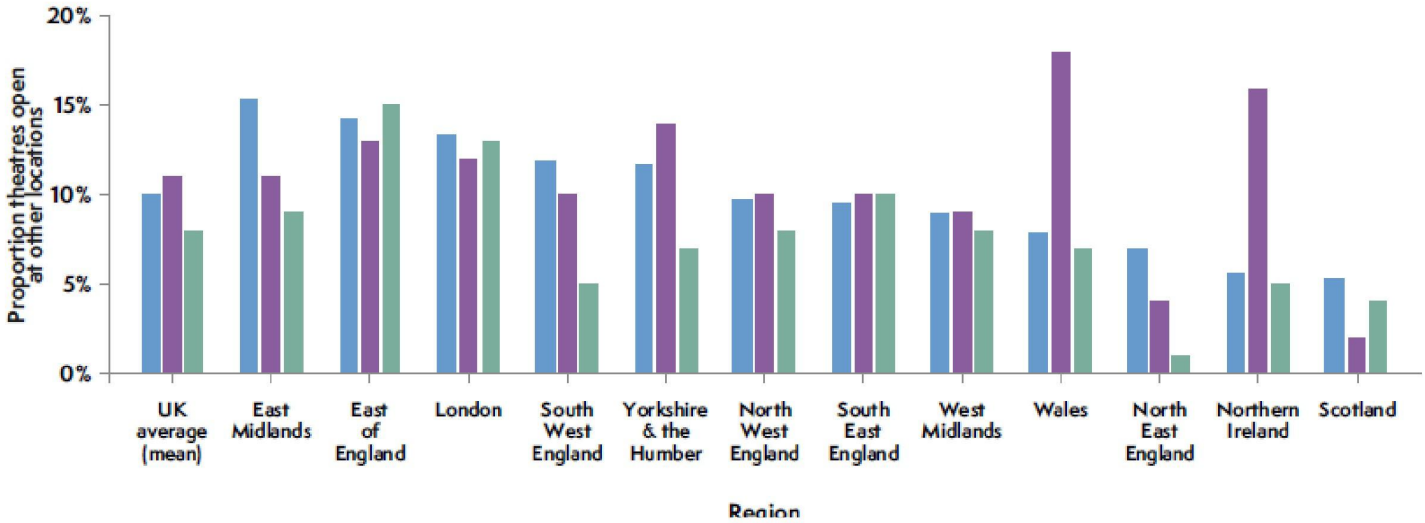


Figure 15: UK and regional variations of the capacity to expand theatre activity to external locations in October 2020 (blue bar), December 2020 (purple bar), and January 2021 (green bar). Expansion is provided as the proportion of theatres that are open at external locations compared to the number of theatres that were open the previous year. Source: Kursumovic E et al., 2021

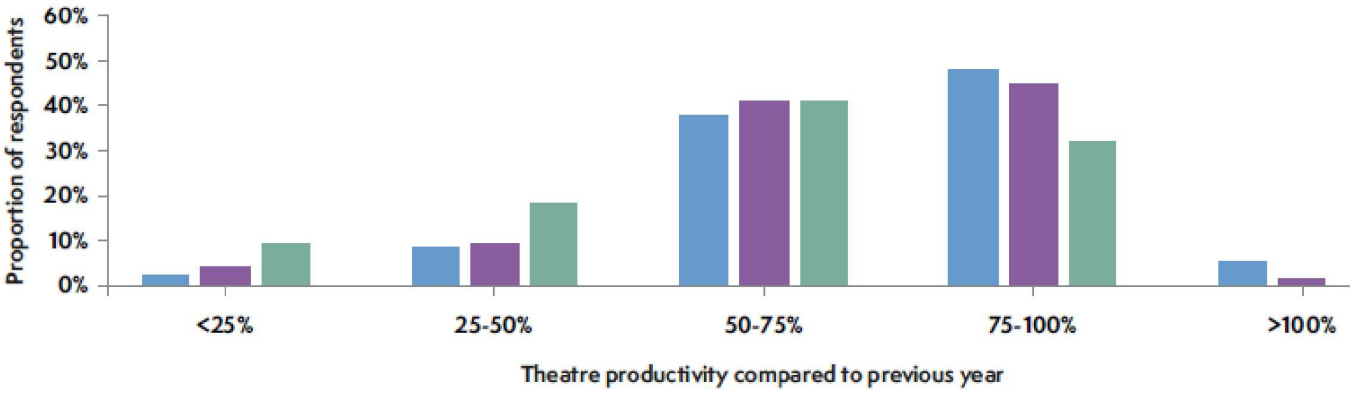


Figure 16: Proportion of respondents reporting theatre productivity in theatres that were open/working, compared with the same period the previous year, in October 2020 (blue bar), December 2020 (purple bar), and January 2021 (green bar). Source: Kursumovic E et al., 2021

190. In those theatres that were working, activity levels were reduced to, on average, 50-75% of normal productivity. The reduced activity was due to infection control precautions, staffing, and procedural changes. Between Autumn 2020 and early 2021, near-normal productivity (75–100%) fell from 48% to 32% and operating at less than 50% productivity increased from 10% to 27%.

191. Around a third of anaesthetic doctors were unavailable for surgical work in January 2021, primarily due to redeployment to ICUs.

192. Compared with the twelve months previously, surgical activity reduced in all rounds of the survey, but most markedly in early 2021. Surgical activity fell to around 50% of normal in early 2021.

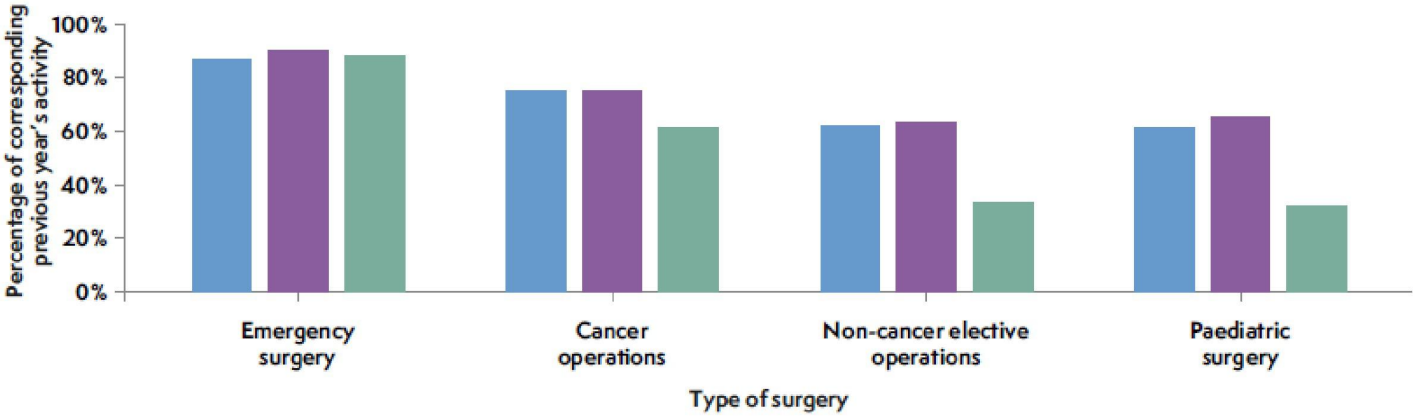


Figure 17: Average UK percentage of surgical activity compared with the same period the previous year in October 2020 (blue bar), December 2020 (purple bar), and January 2021 (green bar). Source: Kursumovic E et al., 2021

193. The impact was greatest on non-emergency work and paediatrics, but there was also a significant impact on cancer and emergency surgery. In one region, paediatric surgical activity fell to around 10% of normal, and overall, non-cancer elective surgery was reduced by two-thirds.

Fig 18a:

Fig. 18b:

Figure 18: UK and regional variations of the average (mean) percentage of a) paediatric surgery activity and b) non-cancer elective surgery activity compared with the same period the previous year, in October 2020 (blue bar), December 2020 (purple bar), and January 2021 (green bar). Source: Kursumovic E et al., 2021

Fig. 19a:

Fig. 19b:

Figure 19: UK and regional variations of the average (mean) percentage of a) cancer surgery activity and b) emergency surgery activity compared with the same period the previous year, in October 2020 (blue bar), December 2020 (purple bar), and January 2021 (green bar). Source: Kursumovic E et al., 2021

194. Overall surgical activity was reduced by around a quarter in autumn 2020, and more than a half in early 2021 - this is equivalent to approximately 5,000 missed operations per day in the autumn, rising to 10,000 per day in early 2021. Over a year, these daily losses equate to 1-2 million surgical procedures. Other sources make similar estimates of surgical workload loss, with the number of patients added to waiting lists estimated at approximately 1.5–2 million [Dobbs TD et al., 2021] and 2 million [British Medical Association, 2021b].

Figure 20: Proportion of operations completed over a 24-h period, from responding hospital, sites compared with the previous year, at R1 (October 2020), R2 (December 2020), and R3 (January 2021). Blue denotes the proportion of active surgical cases completed and purple the proportion of lost surgical cases that were completed on the same date the previous year. Source: Kursumovic E et al., 2021

195. Of note, all of these changes occurred despite best efforts. Survey respondents highlighted factors facilitating perioperative care delivery, including staff flexibility (e.g., new rotas, extra shift work), virtual communication use, and separate low-risk Covid-19 areas. The barriers encountered included staffing issues, critical care beds and operating theatre availability.

196. Staffing was the most significant barrier to the maintenance of perioperative activity. The loss of the anaesthesia and operating theatre workforce was primarily due to redeployment to critical care, resulting in a simultaneous increase in the critical care workforce. The loss of anaesthetic staff due to redeployment to non-patient-facing roles, shielding, self-isolation, quarantine, and sickness due to Covid-19 remained relatively stable between Autumn 2020 and early 2023. The overall impact on national anaesthesia staffing was a 12% loss in October 2020, 15% in December 2020, and 29% in January 2021. In addition to numerical unavailability for operative anaesthesia, the anaesthetic workforce will also have suffered a toll of psychological impact and fatigue from taking part in ICU practice and decision-making outside their clinical areas of confidence, as well as ward intubations and stabilisation under physically challenging Covid conditions, with consequences including sickness and anaesthetic and theatre staff leaving healthcare.

197. The redeployment of operating theatre staff to critical care increased the critical care medical workforce by approximately 38% in October 2020, rising to an approximately 125% increase (i.e. more than doubling) in January 2021.

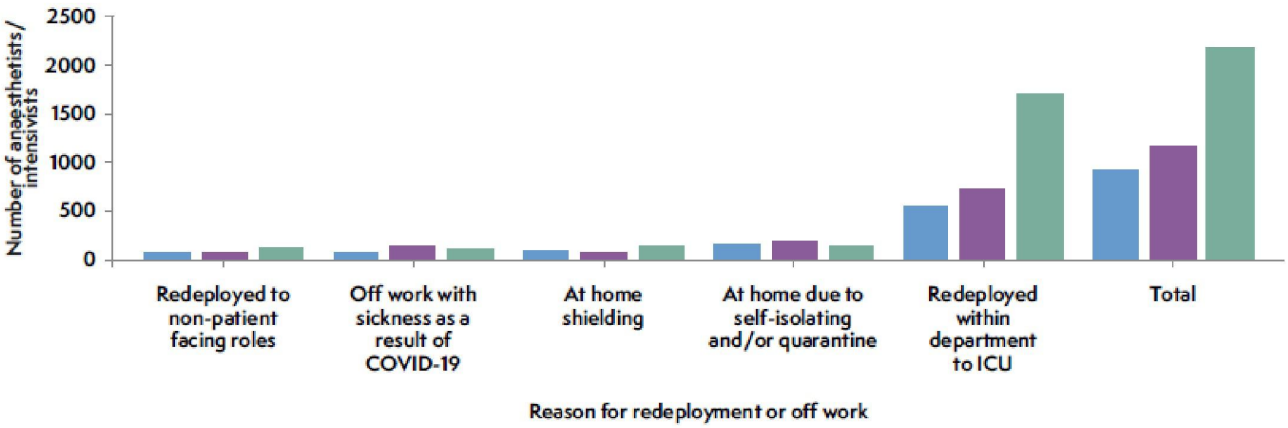


Figure 21: Impact on anaesthesia and critical care staffing levels. Total number of anaesthetists and/or intensivists off work or redeployed to ICU activities as a result of Covid-19 in responding hospital sites at the time of surveys in October 2020 (blue bar), December 2020 (purple bar), and January 2021 (green bar). Source: Kursumovic E et al., 2021

Personal Protective Equipment (PPE)

198. Neither of this report's authors (Professor Summers and Dr Suntharalingam) are experts in infection prevention and control or occupational health but can comment on the impact of PPE guidelines, availability and usage in ICU. Recognition of ICU as a high-risk zone was immediate and universal at the beginning of the pandemic, reinforced by publicly available images of ICU working conditions in China and Italy. In addition to standard PPE used by all healthcare workers, UK guidance on Aerosol Generating Procedures (AGPs) included an extensive list of ICU interventions [NIHR AERATOR team (2022)]. PPE guidance for AGPs recommended enhanced protection compared to standard PPE, involving respirators, eye protection, gloves and long-sleeved disposable gowns, with a necessarily more involved donning and doffing process. There was a range of available PPE to meet the enhanced requirements, ranging from surgical gowns to coveralls and an assortment of different respirator masks, the type/model of which sometimes changed daily as different batches arrived.

199. In general, there were adequate numerical quantities of PPE in ICUs as these were often prioritised over other parts of the health and social care system. However, the available PPE was not always suitable for the end-users, as it was not designed to fit diverse body shapes and sizes - for reasons commented on below regarding respirators. Supplied respirators were sometimes out of date, with reports of the rubber retaining straps snapping during use, leading to accidental exposure in Covid-19 areas. National pre-pandemic stockpiles of PPE were based on influenza recommendations, leading to some local variations and shortages in supplies of additional droplet protection items such as eye protection/visors

and long-sleeved gowns or coveralls, in many cases backfilled by local voluntary, community and commercial manufacture and donations.

200. In the context of intubation of a new Emergency Department (ED) or ward patient and initiation of critical care and mechanical ventilation (a scenario happening multiple times a day in some hospitals during peak surges [Pett E, Leung HL, Taylor E, et al., 2020]), the need to rapidly but safely don PPE in unplanned circumstances was also a complication, but one that could often be mitigated with a combination of early decision-making (i.e. early progress to intubation before a cardiac arrest or other acute crisis), and, in many hospitals, the availability of trained and well-rehearsed intubation teams to supplement the usual critical care roster.

201. Within the ICU itself, concerns about accidental tube disconnection, frequent use of tracheal suction and the pattern of care in a patient with respiratory failure meant that staff usually treated ICU bed spaces of patients receiving mechanical or non-invasive ventilation as permanent AGP/enhanced PPE zones, rather than enhanced protection being donned and doffed only during at-risk times as suggested by Public Health England guidance. In fact, the guidance itself focussed on procedures and did not offer specific advice or a proposed *modus operandi* or modelling for the scenario of routine continuous ICU care, leaving room for interpretation in how the donning and doffing instructions and list of AGPs should be combined into a pattern of advised behaviour at the ICU bedside, where care and (some) interventions, including respiratory, are delivered continuously 1:1, and staff spend continuous time in the environment.

202. When patient numbers were few and patients were being cared for in defined sub-units of the ICU (single rooms or isolated bays), staff involved in bedside nursing remained in enhanced PPE throughout their entire shift in many hospitals. Other professionals whose work involved moving between clusters of patients (doctors, physiotherapists, radiographers, other allied health professionals, and pharmacists) donned and doffed on entry and exit from the immediate area.

203. IPC guidance stated that ICUs where patients were considered to be at risk of infection with Covid-19 were to move to sessional gown and FFP3 wear from 2 April 2020. The interpretation of this varied according to infection control teams, patient numbers, and unit layout, for example, whether the session was inside a closed treatment bay or in all ICU areas, including circulation spaces. Once the number of Covid infected patients in a given unit increased to the point that moving between patients or compartments with repeated donning and doffing became prohibitively time-consuming, many units moved to a cohort model where an entire ICU or large section of an ICU became a single 'hot zone', including not only clinical spaces but desk, stores and computer areas, with all staff donning on entry and remaining in PPE for the duration of a shift, including for documentation, computer use, and telephone communication. Such units typically developed group donning and doffing areas, sometimes with support staff to assist and oversee the donning process.

204. Providing critical care in PPE was physically challenging for all staff. Discomfort from prolonged, shift-long use (often more than twelve hours) of tight-fitting FFP3 masks or powered respirator helmets, the discomfort, heat and potential dehydration of full-length fluid-resistant gowns or coveralls, and difficulties in communicating through masks or helmets were all significant. Physical assessment, nursing care and procedures were all rendered more difficult. The physical impact of wearing PPE for Covid has been reported to include skin irritation, pressure ulcers, and respiratory and sensory difficulties [Tume et al., 2022]

205. The psychological impact of working in PPE in a high-intensity environment with critically ill, often dying, patients is considerable. A sociological study of UK healthcare workers in general (Vindrola-Padros, 2020) identified various factors, including initial fear and uncertainty, especially in redeployed staff; the impact of rapidly evolving PPE guidelines, limited training, linked to fear of getting it wrong and contracting Covid-19 or taking infection home to families.

206. A nursing-specific study of working in Covid-19 critical care (Montgomery CM, 2020) found that generally, ICU staff felt safe in their enhanced PPE (data on FFP3 vs fluid-resistant surgical mark use elsewhere in the hospital suggests that this was indeed the case [Ferris M et al., 2021]). But it comprehensively surveys the challenges, of which PPE-related elements include, difficulty in communication and identification, especially for redeployed working in unfamiliar environments with people who all looked the same in PPE, loss of manual dexterity, numbing of the senses, loss of visual and audio cues, heat, weight, dehydration, facial pain from masks and difficulty in knowing who had the right ICU expertise to ask for help.

207. Cohorted patient placement in the ICU resulted in some unplanned consequences, mostly negative. Many more staff remained in PPE for entire shifts. Non-clinical tasks became more difficult, and aspects such as communicating progress or bad news to patient's families while speaking via masks or helmets contributed to emotional dislocation and moral distress. A cohorted ICU in which every surface was regarded as potentially virally contaminated and everyone visible was either a Covid patient or a colleague in enhanced PPE, made for a very visually alienating environment. Subtle consequences included reluctance to expose skin, which may have impacted compliance with advice to change gloves between patients. As well as the PHE-recommended PPE precautions, additional steps, including head coverings, overshoes, or the use of wipe-clean surgical boots, and disinfection of footwear on exit, became routine on a custom and practice basis. Conversely, the communal donning and doffing areas, combined with the use of a diver-style buddy system to check each other's PPE, provided a degree of shared reassurance and maybe a tiny component of the sense of shared purpose and 'communities of fate' that have been described in sociological studies of staff affected by the pandemic [Montgomery CM, 2020]

208. Working in PPE played a significant part in the physical and emotional challenges of working in the Covid ICU, but it was necessary and protective. ICU staff were arguably safer

than in other parts of the hospital due to recommended use of enhanced respiratory protection (when FFP3 respirators as used in ICU from the outset were introduced to non-critical care areas in Wave 2 in one major hospital, modelling data suggested that ward-based infection fell to effectively zero [Ferris M, Ferris R et al]). However, uncertainty, changing guidelines, anxiety over supplies and fit-testing, contributed to the psychological impact early in the pandemic. There is emerging data on equitable access to PPE: the United Kingdom Research study into Ethnicity And COVID-19 Outcomes in Healthcare workers (UK-REACH), an analysis of responses from over 12,000 healthcare workers across the UK, looked at self-reported available PPE during the first lockdown compared to at the time of the study (March 2021), and found apparent lack of equity in the first lockdown associated with a range of factors including age (with younger workers reporting less access), ethnicity (Asian vs. white), geography (with London healthcare workers experiencing poorer access than other regions), type of work (with ICU staff reporting better access as above, but across all healthcare, those looking after Covid-19 patients in general reporting worse access than those who did not), and profession (with allied health professionals and dentists reporting less access than doctors during first lockdown, but with this effect reversed by the second reporting period). [Martin CA et al, 2022].

209. An under-appreciated fact is that the PPE used in healthcare before, during, and after the pandemic was primarily designed for industrial use in fields such as construction and, as such, is poorly adapted to a diverse healthcare workforce. Remarkably, a traditionally male-dominated field such as firefighting has abolished unisex fire-related PPE and moved towards compulsory testing on male and female models for the last 20 years, while healthcare, with a 75% female and ethnically highly diverse staff base, continues to rely on European fitting standards for its respiratory protection, which are based on a standard, clean-shaven Caucasian male 'Sheffield Head', based on a mould of a single mining safety agency employee from Northern England [Criado Perez C, 2022]. The reasons are historical, but recognition of the issue, the potential impact on staff, and alternative solutions are overdue and may constitute important learning from the Covid-19 pandemic. A UK clinical collaborative began developing options for customisable, potentially reusable (UV-sterilised) respirator masks for use in healthcare during 2020, and this work remains in progress [Feinmann J 2020]. It may have important UK-wide and international implications and opens a broader debate on designing PPE for healthcare, including critical care, rather than repurposing from other industries.

210. The evidence base for the accurate identification of aerosol-generating procedures continues to develop, including recognition that some procedures may be significantly less aerosol-generating than natural respiratory activities such as coughing [NIHR AERATOR team on behalf of NHS IPC Cell, 2022]. Current and future data should inform proactive review and updated guidance for future pandemics. Again, infection prevention recommendations are outside the scope of this report, but a clear lesson from the ICU clinical experience is that reduction of uncertainty and a robust, safe, evidence-based update to the AGP list may help to reduce the negative impact of PPE use in a future

pandemic. Most importantly, hospital-wide guidance that focuses on procedures only as a trigger for enhanced PPE may not be fit for purpose in an ICU setting. There is a need for specialist guidance developed with insights from both infection control and critical care professionals and a shared psychological model of the working methods and environment in ICU – in other words, evidence-based recommendations should be developed and adapted for a care model that involves continuous bedside presence around an infected patient, or multiple patients, receiving intubated or non-intubated respiratory support, rather than only a list of intermittent procedures.

Lessons learned and recommendations.

A summary of the lessons learned in intensive care during the pandemic.

211. Critical care is an inevitable pinch-point in a life-threatening pandemic due to the nature of care it provides, and since skilled staff and equipment are necessarily resource-limited. ICU is the final common pathway for many acute conditions and hospital activities, including both emergency and elective care; therefore, if critical care becomes overwhelmed, almost all healthcare is overwhelmed. Adequate baseline provision for day-to-day care, the ability to scale and escalate when needed, and accurate, timely, intuitive reporting and escalation of frontline strain to senior decision-makers in a way they can understand and act upon are all central to an effective pandemic response.

212. Research and embedding research into routine clinical practice was the critical activity that allowed us to understand the SARS-CoV-2 virus and its transmission, develop surveillance methods, diagnostics, vaccines and therapies, and improve clinical outcomes for people with COVID-19. Without large-scale, appropriately resourced research capacity across the NHS, academia, and the broader life sciences sector, we would not have been able to change the trajectory of the pandemic in any meaningful way. The UK's vibrant academic and commercial life sciences ecosystem and many years of investment by UKRI, NIHR and others (e.g. Wellcome Trust) allowed us to deliver what was required in reasonable timeframes. Much has been learned about how to tackle pandemic threats, and it is vital that this capability and capacity is not lost before the inevitable next outbreak arises. Sustainable resource provision (funding) to ensure initiatives such as ISARIC's Clinical Characterisation programme, pathogen sequencing such as that undertaken by COG-UK, and clinical trial infrastructure across the NHS capable of delivering trials such as RECOVERY are vital to our defence against emerging and other infectious threats. Many of these infrastructural building blocks also provide the potential to improve human health in non-pandemic situations if appropriately supported.

213. The findings of clinical trials were disseminated via several routes – including press releases from investigators, commentary during Downing Street press conferences, and notification from the Chief Medical Officer/Chief Medical Advisor to the UK Government to all four nations via the NHS Central Alerting System [CAS Alert reference CEM/CMO/2020/026,

INQ000283542]. Professional Societies and Royal Colleges also played essential roles in ensuring the rapid dissemination of appropriate information in clinically relevant forms (webinars, clinical guidance, etc). Consideration needs to be given to strategies for minimising the impact of misinformation at times of national emergency so that robust evidence-based information can be rapidly and effectively shared when needed and misinformation can be countered.

214. Despite previous pandemic planning, encountering H1N1 influenza in 2009, and subsequent potential threats such as MERS, the nature of critical care expansion during the Covid-19 pandemic was fundamentally reactive, albeit directed and executed at an impressive and rapid pace, with a high degree of delegated local adaptation and innovation. Behind this undoubtedly heroic response, lies the fact that the UK entered the pandemic with a relative deficit of ICU capacity compared to comparable nations [OECD, 2020]. There is a clear and urgent need for a review of UK-wide ICU capacity and location compared to population distribution and healthcare system needs, with appropriate resourcing of expanded capacity in sufficient numbers and the required locations. Critical care – its staff and facilities – is expensive, and no country can maintain a pandemic-level reserve at all times. However, by entering the pandemic with a shortfall of ICU facilities and staff compared to economically comparable countries, the UK had to stretch further.

215. Significant harm was associated with working under abnormal conditions with staff dilution and delegation, both to redeployed staff and those tasked with supervising and taking responsibility for them. Moral injury, skills dilution, physical discomfort, and difficulties associated with PPE, exposure to higher numbers of dying patients than previously experienced, in addition to experiencing anxiety about the risks to self and family, caused harm, with impacts on staff welfare and functionality that are lasting well beyond the acute phase of a pandemic. It is clear the stretched staff ratios required during the pandemic were unavoidably detrimental to the well-being of ICU staff and ultimately to the overall health of the UK public – both through the immediate potential impact of diluted and delegated care on patient safety and through the longer-term effects on the recovery of the healthcare system.

216. While healthcare staff were being expected to work in ways far outside their training, expectations and values in order to maximise ICU capacity urgently, the professional regulators and leadership of major health-worker groups played an essential and positive role in 2020 by allaying at least one source of staff anxiety through the provision of prompt, clear, co-ordinated reassurance that individuals' clinical registrations and occupations would not be at risk by working outside their usual roles under pandemic conditions: as long as they followed protocols, acted within their best professional judgement, and worked under employer instructions. This was an important and under-recognised step in supporting the psychological safety of UK healthcare workers. The institutional 2020 response and statements should be a model for future emergencies.

217. Funded regional critical care transfer systems with network coordination, trained transfer teams and crews, and robust governance can provide safe and efficient movement of critically ill patients, even over long distances when otherwise unavoidable. Transfers are not risk-free, and sufficient ICU capacity at the point of need remains the best option for critically ill patients. However, service development and learning during the pandemic provided the means to load-balance within and between regions during a pandemic and provide UK-wide access to supra-regional services such as ECMO. These systems remain in place, improving safety during clinically necessary transfer activity, and are a major positive outcome of learning from the pandemic.

218. Information flow upward and downward is key to crisis management. There were divergent ways of expressing capacity between the four nations. Bed counts and numerical occupancy are only one marker of system strain. Indices such as CRITCON, which are intuitive, clinically led and directly connected to hospital strain, are important to provide a more rounded overview of strain on ICU services and should be consistently reported, and should be backed up by an ongoing system of field visits and reporting of actual frontline experiences from a variety of sites. The pandemic emphasised that critical care depends on skilled staff, not only on beds and equipment, and that those staff are highly vulnerable to being harmed by working for prolonged periods under conditions that go against their training and values, bringing about moral distress.

219. Further research is required to understand the minimum safe staffing requirements for various clinical settings under different circumstances and the impact of different staffing models. We are pleased to see that vital learning and updated planning have been incorporated into the latest guidance in England, including structured escalation, formalised activation of critical care transfer services, and planning driven by frontline ICU strain reporting, as well as numeric data [NHS England 2024]. We recommend that the Devolved Administrations formally adopt CRITCON to support harmonised approaches across the UK.

220. The pandemic has highlighted that healthcare is reliant for its Personal Protective Equipment (PPE) on repurposed commercial equipment, which, in the case of respiratory protection, is historically designed to fit a standard male Caucasian industrial workforce. Along with equity and ethical issues, this raises the practical question of why dedicated PPE for healthcare and its predominantly female and ethnically diverse workforce does not exist and how this can be brought about using modern technology and manufacturing. The Covid-19 pandemic brought home the realisation that all health and care workers, not only those in ICU, are at the frontline, and that appropriate design, supply and fitting of protective equipment must be taken as seriously as it is in other safety-critical industries. For equipment suppliers, this also represents a potentially significant new healthcare market.

221. We understand only too well the human impact – on patients, families or others close to them, and ICU staff (including those redeployed to ICU) - of the lack of visitor access to patients at all stages of critical illness from peak acute condition through to recovery and

rehabilitation on the one hand, or care in the last days of life on the other. It is difficult to translate this into universally relevant learning or prescriptive advice for the future without knowing the specifics of future infections and pandemics that may carry broader public health implications and affect the safety of visitors (both in general and for those who may themselves be vulnerable). However, policy variations between health providers may be for valid reasons (occupancy, infrastructure, staffing pressure) or through inevitable variations in practice in a complex healthcare system and in the ability to keep policy updated in line with changing circumstances. It should be possible to address the latter and to make 'best practice' more consistent, universal, and monitored as part of the pandemic response.

Recommendations for the future

222. Defending the UK from outbreaks of novel and emerging pathogens and other infectious threats should remain a high national priority [HM Government, 2023]. Sustainable investment is required to ensure UK nations can rapidly put in place the essential components of effective pandemic response, including pathogen surveillance, early detection, scalable diagnostics, and effective pharmacological and non-pharmacological countermeasures. The ability to deploy such measures depends on the availability of research infrastructure and expertise, robust supply chains, and access to manufacturing capacity. These capabilities should be maintained between public health emergencies to avoid the loss of precious time when an outbreak occurs and to ensure the UK is ready for a wide range of outbreak scenarios.

Capacity, expansion and responsiveness:

223. Within the next two years, a systematic, UK-wide review of baseline ICU capacity and an objective assessment of whether it is adequate and matched to local health needs is required. It should be conducted by an independent body such as the King's Fund or a university, with access to epidemiological expertise to model future needs, and its role should be to scrutinise commissioned NHS critical care capacity, not only in total by nation but also its distribution between and within regions and how well it is matched to local population needs. The review should incorporate independent specialist input from key UK-wide organisations including the Intensive Care Society, the Faculty of Intensive Care Medicine and the UK Critical Care Nursing Alliance, along with their partner clinical organisations, national intensive care societies and independent audit and research bodies such as ICNARC and SICSAG. The population and capacity review should encompass physical facilities, equipment, staffing and working models. A clear plan to invest in and deliver the identified capacity necessary in the UK should be developed, agreed upon, and resourced by the NHS and national Governments. Given that Northern Ireland has more opportunities to co-operate with ICUs in the Republic of Ireland than with units in mainland Britain, both in emergencies and day-to-day, such a review could usefully be conducted in collaboration with the Republic of Ireland.

224. The successful learning regarding critical care transfers should be translated into fully funded, 24/7 transfer systems available across all four nations, subject to local consultation and needs assessment. Along with improving care and safety during the ebb and flow of usual healthcare, the benefits of load-sharing under surge conditions are now well demonstrated.

225. There should be a comprehensive, UK-wide multi-agency planning exercise to capture all relevant critical care learning from the pandemic response by the end of 2025 with forward planning undertaken to encompass not only the next pandemic but other threats with the potential to impact critical care. The UK Government – and the public, as both healthcare users and taxpayers – must now recognise that ICU provision is a core part of the response to any life-threatening public emergency and develop a comprehensive, four-nation critical care emergency response plan that encompasses future threats of all kinds, ranging from infectious and non-infectious health threats, through to interruptions to critical infrastructure or large-scale mass evacuation. One of the most important lessons of Covid-19 is that it is the duty of Government, health and care system management, and frontline professionals alike to imagine and prepare effectively for the unthinkable. In particular, it is vital to avoid misperceptions that ICU as a speciality 'coped' and needs no further investment – this is not the reality.

226. Technical aspects of ICU expansion should be recognised and made part of a mandatory library of site-specific critical infrastructure and surge information, which every Trust and Health Board is obliged to maintain and which is regularly inspected to ensure it is fit for purpose. On an operational level, this would allow rapid access to key information during a future pandemic, with examples including detailed site plans with gas and power supplies; the maximum capabilities of hospital oxygen pipeline supplies under a respiratory pandemic surge, and alternative resilience strategies for organ support (such as the successful installation of additional dialysis facilities at some). When the Covid-19 pandemic hit in 2020, this information often had to be unearthed from records or created afresh.

Communication, understanding, human factors, and ethics:

227. Regular review, training, and rehearsal of capacity and escalation communication and decision-making should occur at regional and national management levels. The scenarios rehearsed should include escalating levels of strain on the healthcare system, including the possibility of overwhelmed ICUs. A particular priority is to test and exercise frontline situational assessment and communication in a manner that ensures adequate information can be provided in a manner that is useful to, understood and actionable by senior decision-makers up to and including Cabinet level, including CRITCON or equivalent, and the use of site visits to capture vital frontline information including the status and morale of personnel, that may escape usual reporting systems. We recommend that the NHS in the Devolved Administrations adopt CRITCON in order to provide a shared language of escalation

228. The well-being of health and care workers exposed to physical and/or psychological harm as a consequence of providing care during a pandemic should be adequately supported in the longer term. The harm experienced by ICU healthcare workers is considerably more sustained than in just the acute phase of a pandemic. There must be recognition that the staff delivering the majority of ICU care are the same ones that have been required to address the backlog in elective perioperative care while carrying significant staff vacancies that have existed since before the pandemic. Serious and rapid consideration must be given to increasing the number of specialist staff trained to provide ICU and perioperative care and to addressing the issue of staff retention.

229. As evident from the balance of topics in this report, critical care is at its heart far more than merely a 'numbers game' of machinery and skilled hands matched against quantities of sick bodies. Perhaps one of the most important lessons from the pandemic is the urgent need for a better dialogue about the individual values and wishes of patients and those close to them, and a deeper understanding of the technological capabilities – and limits – of modern medicine. A UK-wide approach using a recognised framework, such as ReSPECT, is needed to encourage advance care planning conversations and to ensure that there is consistency in the provision of information and the recording of treatment recommendations. Such an approach must be accompanied by a comprehensive staff education package and substantial public engagement to ensure that honest, appropriate, and respectful advance care planning becomes part and parcel of day-to-day health and social care for all of us.

230. To address the issue of a future public health emergency, we recommend a Citizen's Assembly or other formal Government consultation with an appropriate range of stakeholders, to develop clear moral and ethical guiding principles for resource-limited clinical prioritisation in the event of a crisis. In the period between Covid-19 and any future public health emergency, it is vital to have consulted society-wide and developed an agreed, fair and just framework regarding how we should use and allocate healthcare resources in a situation when demand acutely outstrips supply (so-called triage). This nettle should be grasped to allow honest conversations and consider all views, including those of vulnerable or potentially disadvantaged groups, in advance of future needs and public health emergencies.

Annexe 1: References

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Annexe 2: Summary of major late-stage clinical trials for Covid-19

(Trials included where they recruited patients in the UK and where results are available)

PHASE 3 TRIALS RECRUITING UK HOSPITALISED PATIENTS			
Therapy	**Trial**	**Announcement**	**Date**
Hydroxychloroquine	RECOVERY	Press release	05/06/2020
		Preprint	15/07/2020
		Publication	08/10/2020 *(NEJM)*
Dexamethasone 6mg (corticosteroid)	RECOVERY	Press release	16/06/2020
		Preprint	22/06/2020
		Publication	25/02/2021 *(NEJM)*
Lopinavir-ritonavir	RECOVERY	Press release	29/06/2020
		Publication	05/10/2020 *(The Lancet)*
Remdesivir	ACTT-EU/UK	Publication	08/10/2020 *NEJM*
Azithromycin	RECOVERY	Press release	14/12/2020
		Pre-print	02/02/2021
		Publication	13/02/2021 *(The Lancet)*
Convalescent plasma	RECOVERY	Press release	11/01/2021
		Preprint	10/03/2021
		Publication	14/05/2021
Tocilizumab (IL-6 receptor antagonist)	RECOVERY	Press release	11/02/2021
		Publication	30/04/2021 *(The Lancet)*
Tocilizumab (IL-6 receptor)	COVACTA	Publication	25/02/2021
Colchicine	RECOVERY	Press release	05/03/2021
		Pre-print	18/05/2021
		Publication	18/10/2021

			(Lancet Respiratory Medicine)
Aspirin	RECOVERY	Press release	08/06/2021
		Preprint	17/11/2021
		Publication	08/01/2022 *(The Lancet)*
Casirivimab-Imdevimab	RECOVERY	Press release	16/06/2021
		Preprint	16/06/2021
		Publication	11/02/2022 *(The Lancet)*
Therapeutic anti-coagulation	REMAP-CAP	Publication	26/08/2021 *NEJM*
Baricitinib	RECOVERY	Press release	03/03/2022
		Pre-print	29/07/2022
		Publication	30/07/2022 *(The Lancet)*
Dexamethasome 20mg (corticosteroid)	RECOVERY	Preprint	16/12/2022
		Publication	12/04/2023 *(The Lancet)*
Angiotensin converting enzyme inhibitors and angiotensin receptor blockers	REMAP-CAP	Publication	11/04/2023 *JAMA*
Empagliflozin	RECOVERY	Press release	19/04/2023
		Preprint	19/04/2023
		Publication	18/10/2023 *The Lancet)*
Intravenous vitamin C in hospitalised patients	REMAP-CAP	Publication	25/10/2023 *JAMA*
PHASE 3 TRIALS RECRUITING UK CRITICALLY ILL PATIENTS			
Therapy	**Trial**	**Announcement**	**Date**
Hydrocortisone (corticosteroid)	REMAP-CAP	Publication	02/09/2020 *JAMA*
IL-6 receptor antagonists (tocilizumab or sarilumab)	REMAP-CAP	Press release	07/01/2021
		Preprint	07/01/2021
		Publication	25/02/2021 *NEJM*

Lopinavir-ritonavir	REMAP-CAP	Publication	12/07/2021 *Intensive Care Med*
Therapeutic anticoagulation	REMAP-CAP	Publication	26/08/2021
Convalescent plasma	REMAP-CAP	Publication	04/10/2021 *JAMA*
Antiplatelet therapy (aspirin or P2Y12 inhibitor)	REMAP-CAP	Publication	22/03/2022 *JAMA*
Continuing therapeutic anticoagulation on ICU admission	REMAP-CAP	Publication	31/05/2023 *Intensive Care Med*
Simvastatin	REMAP-CAP	Publication	21/12/2023 *NEJM*
PHASE 3 TRIALS RECRUITING UK PATIENTS IN COMMUNITY SETTINGS (PREHOSPITAL)			
Therapy	**Trial**	**Announcement**	**Date**
Doxycycline	PRINCIPLE	Press release	25/01/2021
		Publication	27/07/2021 *Lancet Resp Medicine*
Azithromycin	PRINCIPLE	Press release	25/01/2021
		Publication	04/03/2021 *The Lancet*
Inhaled budesonide	PRINCIPLE	Press release	12/04/2021
		Publication	10/08/2021 *The Lancet*
Colchicine	PRINCIPLE	Preprint	23/09/2021
Molnupiravir	PANORAMIC	Press release	22/12/2022
		Publication	28/01/2023 *The Lancet*
Ivermectin	PRINCIPLE	Press release	13/03/2024
		Publication	29/02/2024 *Journal of Infection*

Annexe 3: List of figures