



# The NHS is complex, and that's why we should be worried

As covid cases rise, the loss of critical staff is causing a crisis in the NHS

Martin McKee,<sup>1</sup> Christina Pagel,<sup>2</sup> Deepti Gurdasani<sup>3</sup>

<sup>1</sup> London School of Hygiene and Tropical Medicine, London, UK

<sup>2</sup> Clinical Operational Research Unit, University College London, London, UK

<sup>3</sup> William Harvey Research Institute, Queen Mary University of London, London, UK

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It was a step too far for ninety nine Conservative MPs. They were simply unwilling to support the government's proposal to require people attending large events, such as football matches, to show that they had been vaccinated or had a recent negative test. Yet, a few days later the argument seemed rather academic. Only a handful of matches actually took place. Football players across the country were coming down with covid-19. At the same time, those looking forward to a pre-Christmas trip to a West End show were finding these were also cancelled, for the same reason. What these events have in common is that those falling ill have specialised skills. Those paying often very high ticket prices expect to see the stars of the pitch and the stage, not someone passing by who once played or sang as an amateur. But it's not just football and the theatre. There are many other places where the loss of a few people with particular skills can bring the entire enterprise to a halt. And what is worrying ministers and their advisers is that the NHS is one of them, along with many other critical services. Throughout the pandemic, health and care workers have been at increased risk of contracting and dying from covid-19.<sup>1,2</sup> But if they become infected they also create a risk to those they come in contact with, who inevitably will include many vulnerable patients.<sup>3</sup> It is imperative that they isolate until no longer infectious. And if they have specialist skills, as many of them do, their absence means that their teams may become unviable.<sup>4</sup> You simply can't expect an orthopaedic surgeon to operate on someone with a brain tumour.

This is a reminder of something that many people fail to understand. The NHS is a complex adaptive system.<sup>5</sup> This is important. We all know it is complicated. There are questions about whether even health ministers actually understood how it worked.<sup>6</sup> Complex adaptive systems have certain properties. One is path dependency. Where you start from matters. If your hospital is designed in a way that makes it difficult to redesign and repurpose when needed, then you have problems. This is always going to be a problem. After all, hospitals are built to last. They are not like conference centres where you can simply move partitions around (and as we saw with the Nightingale hospitals, it takes a lot more than space, beds, and partitions to create a hospital). But many NHS hospitals face problems not experienced in most other countries. The Private Finance Initiative means that any major changes will require complex and expensive renegotiation with whoever runs the hospital.<sup>7</sup> And when you need to make changes rapidly, they hold all the cards. We should not underestimate the ingenuity with which NHS staff did adapt facilities during the pandemic, but this was often despite the system.

Second, there are variable lag periods. Some things happen at once, or almost so. A virus that is doubling every two days leaves little time to adapt. But training a doctor takes five years, and several more to gain specialist skills. We cannot magic up thousands of new doctors or nurses in a few months. At the same time, many experienced staff have left, from primary to intensive care. A significant proportion (>3%) now report long covid symptoms, higher than any other occupation.<sup>8</sup> Traditionally, the answer (at least for the UK) was to recruit trained staff from abroad (here we note, but temporarily set aside the important ethical issues). But this is made more difficult when government policies have created a hostile environment for migrants, coupled with disincentivising bureaucratic barriers for those who might come from the EU.<sup>9</sup>

Third, many of the relationships involved are non-linear. This is something that most people should now be familiar with, given how often politicians and scientists have talked about the exponential growth of covid-19. But are they really? You can try this one. Waterlilies start growing on a pond, doubling every day.<sup>10</sup> In 20 days they will cover the entire surface. When will they cover half of it? Now of course, the answer is day 19. But when asked, surprisingly few people get it right. But maybe this isn't so surprising because, time and again throughout the pandemic, politicians have made decisions that are incompatible with this principle. As a result they act late, when even a few days would have made a huge difference.

But there are other non-linear relationships to consider. One is the example we started with. If the star of the show and his or her understudy have to isolate, the show will be cancelled. If a different two people are ill, for example two of the box office staff, it is likely that it will go on. So the calculations of risk involve more than numbers. One particularly scarce resource are ICU nurses, who are so crucial for providing care to critically covid patients, but who are leaving the service after the trauma of three covid waves and the prospect of a fourth.<sup>11</sup>

Bed capacity also changes non-linearly with hospital infections. If someone is found to be infected on a ward, the ward needs to quarantine, and any available bed space on the ward cannot be used until everyone is tested and those infected are isolated, and space freed up. So covid-19 infections in hospitals tend to use up more bed space than just those infected. This makes it critically important to reduce spread within hospitals with high-quality masks and ventilation.

And finally, there are feedback loops. When NHS staff isolate the urgent work doesn't go away. We can compensate for a while, discharging patients faster

and cancelling non-urgent care. But the pressure on those who are still at work gets greater and greater until, at some point, they can take it no more. And routine care that's delayed manifests in more unplanned admissions and increased need for urgent care, further diverting resource from routine care. And so it goes on. But again there are other feedback mechanisms. Higher rates of the infection in the community and poor infection control protocols, and inadequate personal protective equipment (PPE) in hospitals means that more patients will bring it into hospital, potentially infecting those who are there for other reasons, increasing the workload even further.

When we put all of these things together, the dangers should be obvious. At some point there is a real danger that the system will no longer be able to cope. The warning signs are already here. As the omicron variant spreads through the population the Mayor of London has declared a critical incident. This is not because hospitals are facing unprecedented numbers of admissions. They are rising but not, so far, as rapidly as in the past. Instead it is the loss of critical staff prompting the declaration. But unlike with a football match or a West End show, postponement or cancellation is not an option. If people get sick, they will need care.

Meanwhile, much of the political and media debate is dominated by comments like “surely this variant only causes mild illness,” ignoring how the population in South Africa is far younger than in the UK and considerable differences between the level of population immunity in their previous and current waves. A recent report from Imperial did not support claims that omicron is significantly less severe than delta.<sup>12</sup> But mildness is not even the main concern. Rather, what matters is that every health worker who becomes infected must isolate for 10 days to protect their colleagues and patients. And, as we have seen, the loss of a few key individuals will have much wider consequences. Staff who are contacts of cases are now being asked to come in to protect staffing numbers—but increasing the chance of nosocomial transmission.<sup>13</sup> Covid outbreaks in hospitals are already going up in the age of omicron.<sup>14</sup> Leaving aside all the other issues, such as the threat to those who are immunosuppressed and the avoidable burden of long covid, we can surely understand why those advising ministers are concerned.<sup>15</sup>

We have had some lucky escapes in the past. The most plausible explanation for the large spike in deaths in England and Wales in January 2015 was the NHS just about coping.<sup>16</sup> It recovered rapidly, but we may not be so lucky next time. There is a real risk that the omicron variant could change this. And while it is understandable that a prime minister, battered by loss of parliamentary support and a continuing stream of embarrassing revelations about parties, would seek to “save Christmas,” this cannot be at the expense of the lives of the people he was elected to protect.<sup>17</sup> We need measures that can reverse the rise in cases rapidly. We need adequate high quality PPE and ventilation in hospitals. Vaccine boosters are crucial, but they take time to administer and take effect. Independent SAGE and SAGE have called for an immediate circuit breaker.<sup>18 19</sup> And we need it now.

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