

## Are we getting better at treating COVID-19?

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**COVID-19 Actuaries Response Group – Learn. Share. Educate. Influence.**

### Summary

Comparing COVID-19 deaths against hospital admissions shows that the in-hospital mortality of COVID-19 patients has roughly halved from April to June.

We discuss the possible drivers for this, and conclude that the improvement comes from a combination of hard-earned understanding leading to better treatment, and better staff-to-patient ratios. This great improvement will, we hope, help in any second wave.

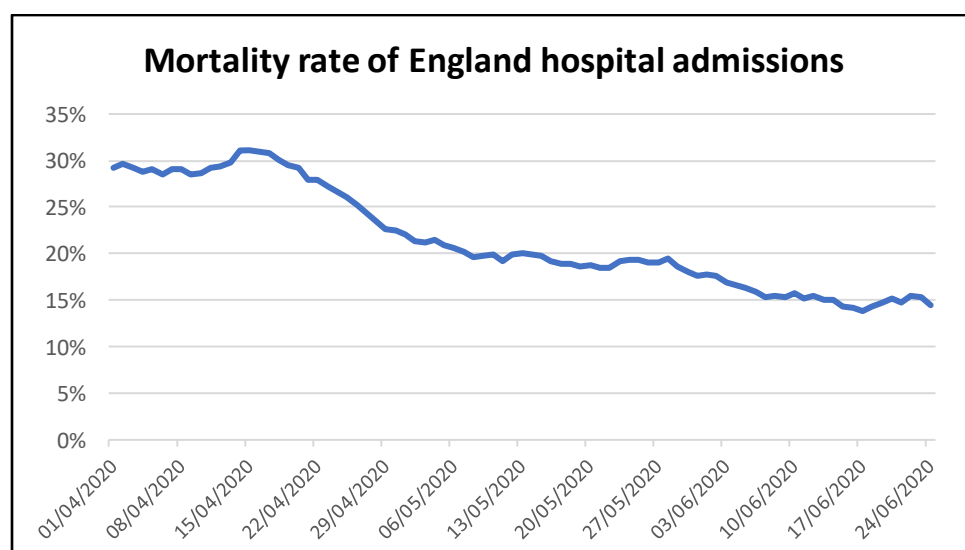
### Method

Amongst the plethora of statistical information churned out daily and weekly is a nugget of interest, which a simple division yields. It appears as though our hospitals have become increasingly successful in treating COVID cases, comparing reported deaths with admissions.

The data used is the hospital admissions as was originally published in the daily datasets accompanying the slides for the Government Daily Briefings, together with the NHS daily deaths for England published at 2pm each day. (The former dataset was replaced by a new dashboard from 29th June.) To smooth the data, we've taken a rolling 7-day average of admissions and deaths, and shifted the data by 6 days to allow for the typical period between admission and death. (This appeared to have the closest fit between the two sets of data.)

### Results

We can see that since the peak of deaths in April the mortality rate of those admitted has fallen from over 30% to under 15%. As there is a significant reporting delay in some deaths, we have taken the analysis up to a point around three weeks ago.



## **Possible explanations**

Does this truly show an improvement in treatment, or are other factors at play that give the illusion of improvement? So let's start by considering the "Ah, but ..." possibilities that might give a false picture.

A possible reason for an improving position could be that hospitals are now more able to admit cases on the margin, whereas in early April the pressure they were under meant you had to be really ill to be admitted. That would increase the denominator, and assuming these cases would always have survived, bring the rate down. But if you look at the positive case counts, across the UK these peaked at around 5,000 per day, and by late June had dropped to around one fifth of that. In contrast, over the same period hospital admissions had fallen from around 3,000 per day to 300, a much greater fall, so that theory would appear to be unlikely.

Another possibility is that in the earlier period more patients were transferred into hospital as deathbed cases – most likely from care homes – with no real opportunity for clinical intervention, thus increasing the numerator. Helpfully the ONS recently released an analysis of care home residents who died in hospital, and this data suggests that there's no obvious evidence to support that theory.

## **Drivers of improvement**

So, let's assume that the data isn't misleading. What drivers could be at work here?

Many of us will have seen TV reports at the height of the pandemic of overstretched ICU units, not only battling a new and unfamiliar illness (while encumbered by PPE), but running at maximum capacity. (We should note that, although many staff were themselves absent with the virus, or self-isolating, there had been huge internal restructuring and redeployment of staff in the NHS, so that ratios of staff to patients were higher than normal.)

And many of those staff would have been new to ICUs at the outset, and had to learn routines and a whole new 'language' quickly (as discussed [here](#)), quite apart from the point about specific clinical learnings. And while that happened, the ratio of medical staff to patients will have materially improved over the period as patient numbers decreased.

Secondly, it is clear that the medical profession has rapidly improved its understanding of what interventions work best.

ICU doctors have mentioned various aspects to us, all learned in the 'heat of battle' – effective use of anticoagulants, steroids, and remdesivir (albeit access to this has been limited). The key to the management of COVID-19 has been supportive care. It became clear very early that COVID-19 wasn't the same viral pneumonia as influenza. It presents with a different pattern of lung injury and has a much higher rate of thrombosis in both large blood vessels and in the tiny vessels involved in gas exchange in the lung. Increased anticoagulation has been effective here.

Patients with COVID-19 also have a much more prolonged illness presentation than those with influenza, and in those patients who deteriorate around day 10 there is evidence of immune dysregulation and increased inflammation. This is why steroids have been effective.

In addition to the specific medications found to be effective, there has been a steep learning curve regarding other parts of treatment. Much better fluid management, where the traditional pneumonia strategy of conservative fluid management has been relaxed (because with COVID-19, renal vulnerability has been a new problem). Better ventilation approaches, where the standard ventilation approach was found to be potentially harmful (owing to the unusual way in which COVID-19 attacks the lungs, and the vascular damage of the lungs in particular leading to increased thrombosis).

One indicator of improved interventions is that the proportion of admissions subsequently entering ICU units has fallen over time. At the height of the pandemic, comparing the weekly ICNARC ICU data against admissions shows around 15% were entering ICUs. A little over a month later that had fallen to around 5%.

The learning, of course, has not been done by doctors in isolation. As more has been learned, more has been communicated, and there are now some excellent resources collating new and better treatment guidance (for instance, [BMJ](#) or [Brigham](#) as a similar US example).

### **Misleading media?**

The above points are all about clinicians making incremental steps that have improved outcomes with little publicity. But the media focus has tended to be on the potential for a step change from a new drug or treatment.

Some of the media coverage has therefore over-simplified complex situations – for instance, the publicity surrounding the production of CPAP (Continuous Positive Airway Pressure) non-invasive ventilators by Formula 1 manufacturers. CPAP has now become exceptionally controversial in the medical community, and in some patients may be harmful. Indeed, the use of CPAP has apparently caused the oxygen supplies of several UK hospitals to fail.

Likewise the announcement of the successful trial of Dexamethasone in early June, whilst welcome, will have played only a small part in the improvement seen. The trial implied a 35% reduction in mortality in ventilated patients, 20% in others. However, although very material improvements ‘per patient’, the impact on the overall numbers in hospital will have been relatively small.

### **Conclusion**

So we think there are a couple of conclusions here.

First, the NHS has become more effective in treating COVID-19 and we should probably be recognising this achievement more than has been the case.

Secondly, this improvement will be of great benefit in dealing with any second wave, although of course system pressures could return as a negative influence. One would hope that any restrictive interventions will be timely enough to ensure that hospital admissions don’t explode in the way they did in late March, though with further restrictions being lifted at the start of July, only time will tell.

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