



Health Care Infrastructure – The Challenges

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

We are reliant upon healthcare capacity to reduce the severity of this pandemic in terms of morbidity and mortality. One of the key challenges will be how a health system copes in times of increased demand. This is contingent upon:

1. Existing capacity – beds, staff, other resources
2. Ability to create extra capacity – repurposing of hospital space and re-allocating staff

The next table displays an overview of bed and staff numbers across selected populations in order to compare the UK with other countries.

Country	ICU Beds/100,000	Acute beds/100,000	Nurses/1000	Doctors/1000
UK	6.6	2.5	7.8	2.9
Spain	9.7	3	5.7	3.9
Italy	12.5	3.2	6.7	4
Germany	29.2	8	12.9	4.3
US	34.7	2.8	11.7	2.6
Canada	9.5	2.5	10	2.8
France	11.6	6	10.8	3.4
S. Korea	10.6	12.3	6.9	2.3
Japan	7.3	13.1	11.3	2.4
Switzerland	11	4.5	17.2	4.3

Ratios of healthcare staff to patients in the UK are much lower than many other countries therefore the ability to deal with a surge in demand is much lower.

As we know, the UK has fewer ICU and general acute beds per 100,000 population compared to other countries, and bed occupancy rates are high. Currently acute general beds are running at up to 92% occupancy in some hospital trusts (**figure A**) and ICU at around 83% (**figure B**).

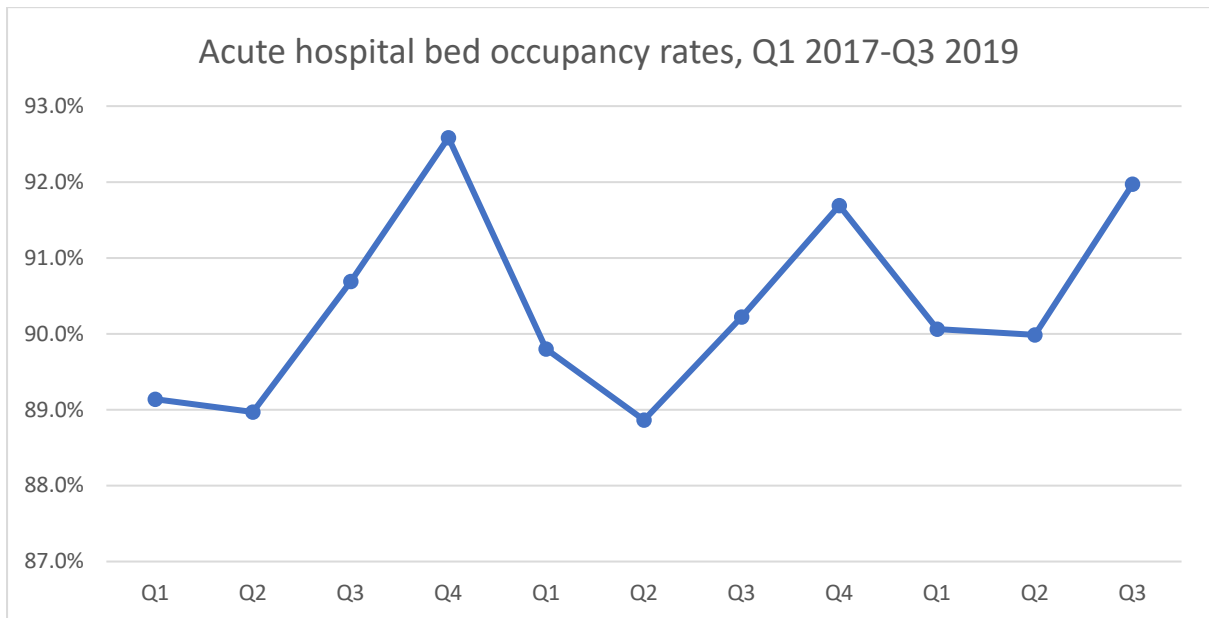


Figure A. Acute hospital bed occupancy rates (NHS, 2020b)

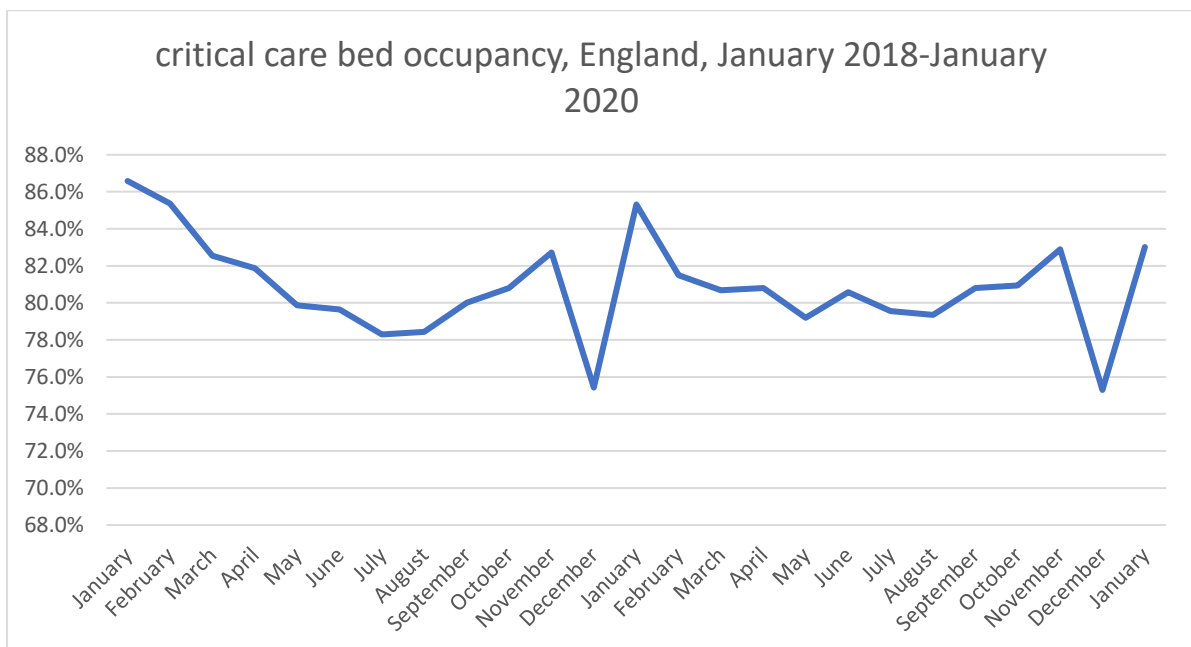


Figure A. Critical care bed occupancy rates (NHS, 2020a)

Unfortunately, there is an existing health service staffing vacancy crisis, and so the ability of the NHS to scale up and provide surge capacity is limited. Over the last 35 years, there have been considerable changes to the way health services are delivered: there have been clinical innovations, changes to practice and the development of community services. The excess bed capacity that was previously in the system to accommodate large numbers of inpatients no longer exists.

Therefore, the UK Government has sought to address this through a number of strategies.

UK Government Strategies

Within the last week, the Government announced that it had struck a deal with the independent sector to re-provision resources from the private healthcare sector to extend its capacity for 3 months. This has been reported to include an additional 10,000 nurses, 700 doctors and 8000 other clinical staff. 8000 hospital beds will be made available and 1200 ventilators. However, it is unclear whether the UK will continue to have access to the additional private capacity beyond the end of June if required.

In addition, all NHS Trusts have been asked to free up 30,000 (or more) of the English NHS's 100,000 general and acute beds through a number of strategies that include:

- the postponement of all non-urgent elective operations
- urgently discharge all hospital inpatients who are medically fit to leave (however, we know that the social care system is already buckling and additional demand could be catastrophic)

The construction of a field-type hospital at the Excel Arena in London, which will treat up to 4000 previously fit and healthy people with COVID-19 and requiring hospitalisation, is under way. (Initial capacity will be 500 beds). Other field hospitals are being created at the Manchester Central Conference Centre and potentially at the Scottish exhibition centre in Glasgow.

However, coronavirus hospital admissions are expected to remain at around roughly 1,000-a-day for the next two to three weeks before "stabilising", according to the government's chief scientific adviser.

Preparedness and Risk

The UK still lags many other countries with regard to preparedness and surge capacity in this regard. Strategies to reduce the impact of an acute demand in healthcare must consider these factors. For example, there is a clear association between staffing numbers and mortality.

A 2007 systematic review and meta-analysis by Kane et al found that increased Registered Nurse (RN) staffing is associated with lower hospital related mortality in intensive care units (ICUs). The addition of a full time equivalent nurse per patient day was reported to be associated with reductions of mortality of 9% as well as a 30% reduction in risk of hospital acquired pneumonia, 60% reduction in unplanned extubation and respiratory failure in intensive care patients and a 28% reduction in 'failure to rescue'. Length of stay in hospital was around 25% shorter in intensive care patients with each additional full time equivalent nurse per patient day.

West et al (2014) find a statistically significant association between the number of nurses and doctors available in Intensive Care Units and patients' chances of surviving their stay in ICU and for up to 30 days after admission to hospital. The size of the nursing workforce in ICUs has the greatest effect on the most severely ill patients, whereas the number of doctors seems to be important across the range of patient acuity. In addition to accessing private sector capacity, other strategies to increase nurse and doctors numbers include asking recently retired staff to assist. Soon-to-be qualified nurses and doctors are also adding to the staffing capacity.

A 2018 meta-analysis involving 175,755 patients, from six studies, admitted to ICU and/or cardiac/cardiothoracic units showed that a low nurse-to-patient ratio decreased the risk of in-hospital mortality by 14%. (Driscoll et al, 2018). Additionally, each 10% increase in the proportion of nursing personnel who are professional nurses is associated with an 11% decrease in the odds of patient deaths after general surgery (Aiken et al, 2016).

Consequences and Challenges

If all NHS capacity was to be directed to caring for Covid-19 patients, it's unclear as to the consequences for those patients who would have ordinarily received treatment in ICU. This has not been reflected in any of the published models to date. The indirect impact of Covid-19 on fatality rates needs to be considered. In addition, further research is required to establish the extent to which Covid-19 victims will have required hospitalisation or would have died in the ordinary course of events had Covid-19 not occurred.

Caring for a patient in ICU requires additional training and experience that cannot be learnt in a matter of days. For nurses, it requires the minimal training period, 3 years, followed by additional post-graduate qualifications and experience. For doctors, even longer. This means that staff from other specialities are not able to be reassigned to ICU without the correct qualifications and experience. Plus, there will still be emergency admissions, trauma cases, septicaemia, heart attacks, strokes, that may require intensive care.

Once the curve of the pandemic has been flattened, it will take a considerable amount of time for the NHS in the UK to restore capacity and currently over-burdened public healthcare systems will take quite some time to get back to normality and to begin clearing pent-up backlogs. This is an area for further investigation and modelling.

The so-called “bounceback” of health events will continue and, for many other health perils, patients will have deteriorated whilst waiting to access healthcare. Perils where early treatment would have led to early resolution may now require longer and more complex treatment. This will therefore place an additional burden on the post-pandemic healthcare system.

References

Aiken L et al; (2016) Nursing skill mix in European hospitals: cross-sectional study of the association with mortality, patient ratings, and quality of care **BMJ Qual Saf** 2017;26:559–568.

Kane R et al (2007) The Association of Registered Nurse Staffing Levels and Patient Outcomes Systematic Review and Meta-Analysis **Med Care** 2007;45: 1195–1204

NHS (2020a) <https://www.england.nhs.uk/statistics/statistical-work-areas/critical-care-capacity/> [accessed 20th March 2020]

NHS (2020b) <https://www.england.nhs.uk/statistics/statistical-work-areas/bed-availability-and-occupancy/bed-data-overnight/> [accessed 20th March 2020]

West E et al (2014) Nurse staffing, medical staffing and mortality in Intensive Care: An observational study **International Journal of Nursing Studies** 51 (2014) 781–794