

Covid-19 hospital mortality

A comparison of first and
second waves across England,
Wales and Northern Ireland





Context

While the UK vaccination programme seems set to vastly reduce the prevalence of Covid-19 over the next 12 months, there's no magic bullet for the treatment of those with the disease. Monitoring mortality rates for those who have been hospitalised will continue to be important.

Covid-19 is excluded from standard risk-adjusted mortality models, so CHKS has developed a method for comparing in-hospital mortality rates specifically for patients with confirmed Covid-19. The model allows hospitals to compare their actual deaths with an expected figure given the case mix (age and sex) of their own Covid-19 cases.

Full details of the approach are set out in a separate paper.

The model's coefficients changed significantly between the first and second waves. This paper describes how they have changed and why.

Summary

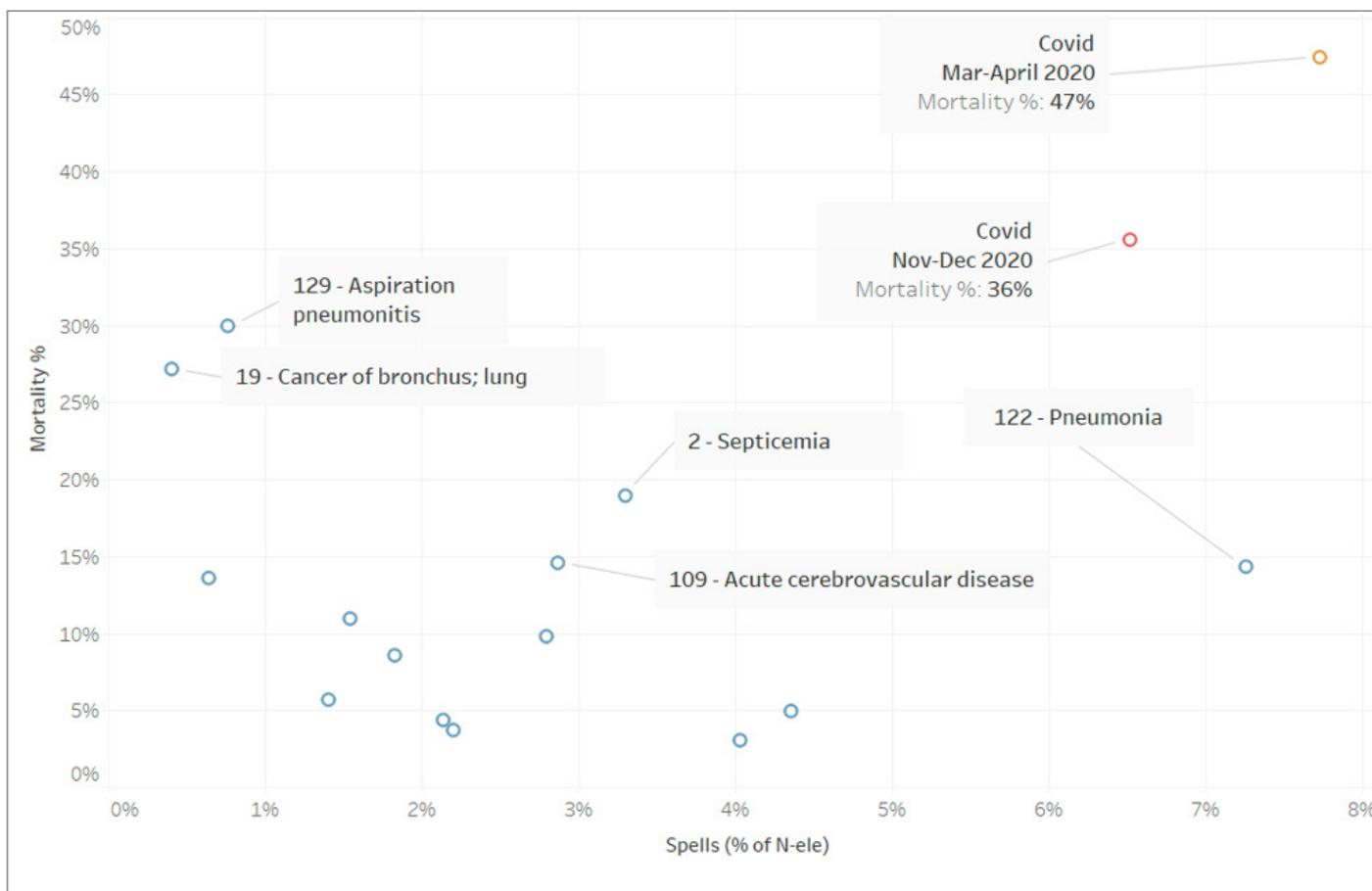
Our analysis concludes that:

1. Risk of death reduced markedly for all ages but remains higher than for all other serious hospital conditions
2. Improvements in Covid-19 survival between first and second waves was greatest with younger patients. Risk of death more than halved for patients younger than 55 and reduced linearly with age. There was only a slight (10%) improvement for the most elderly patients
3. We also found evidence of reduced admission thresholds during the summer lull between the first and second waves: average age, comorbidity and mortality all reduced while length of stay increased
4. The new CHKS method enables trusts to benchmark Covid-19 mortality effectively, using standard funnel plot visualisations. Covid-19 mortality performance across England, Wales and Northern Ireland appears to be relatively consistent between trusts / boards, with little 'excess dispersion' introduced by the new model.

1. Risk of death was lower in second wave, but remains very high

The most common age of Covid-19 admissions and deaths is between 75 and 85 years. At the start of the pandemic (March-April 2020), nearly half (47%) of this cohort died. But by the beginning of the second wave (October-December 2020), this had reduced to just over a third (35%), representing a 25% reduction in overall risk.

This is illustrated in the chart below. To put it into context, we have plotted both Covid-19 waves alongside a backdrop of other 'normal' high-mortality non-elective hospital conditions.



Source: Non-elective admissions of 75-85-year-olds, England, Wales, NI, 2019 (blue). 2020 Covid-19 cases as indicated. Conditions with fewer than 1,000 deaths per year not shown for clarity.

As the current wave ends, Covid-19 cases are expected to reduce, so the Covid-19 position will move much further to the left. It will also move further downwards as treatment further improves and, with less pressure on beds, admissions thresholds will decrease (evidence for variation in admission thresholds is discussed in section three below).

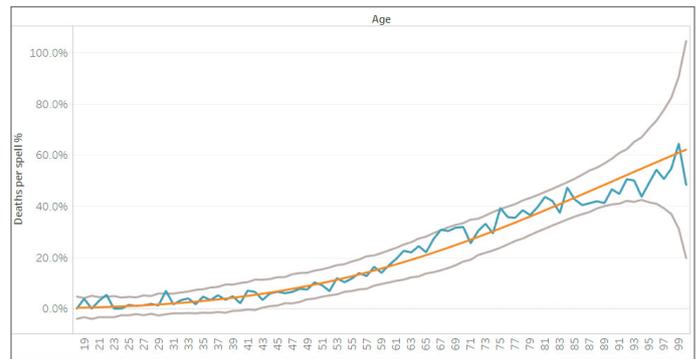
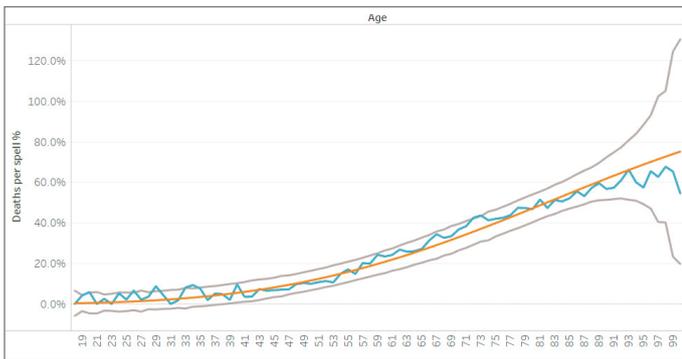
While the crude mortality figures shown above are useful for context, a better approach analytically is to adjust for age and sex. The CHKS method for adjustment uses a continuous function of age, allowing the shape of the risk-age curve to be seen and properly calibrated

against empirical reference data. It models the shape of this curve very effectively, as shown in section two, and results in little dispersion, as shown in section four.

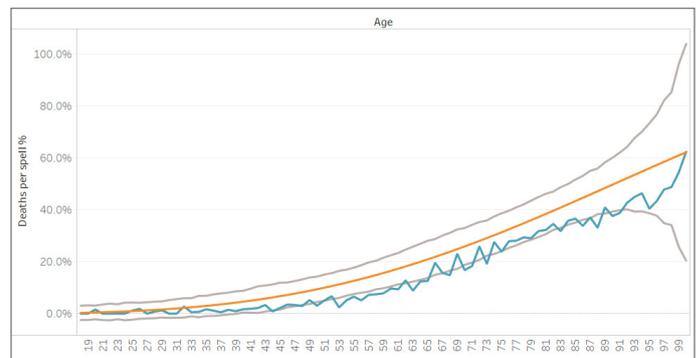
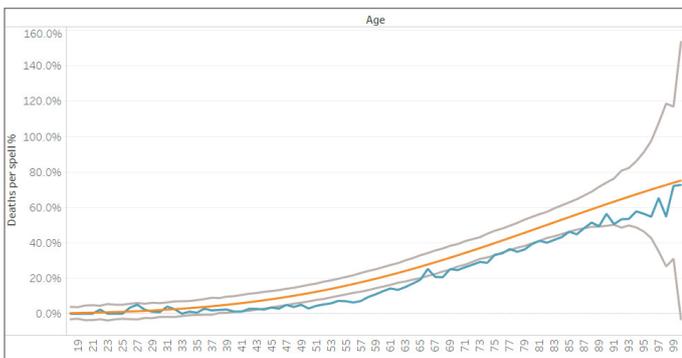


2. Risk of death reduced most of all in younger patients

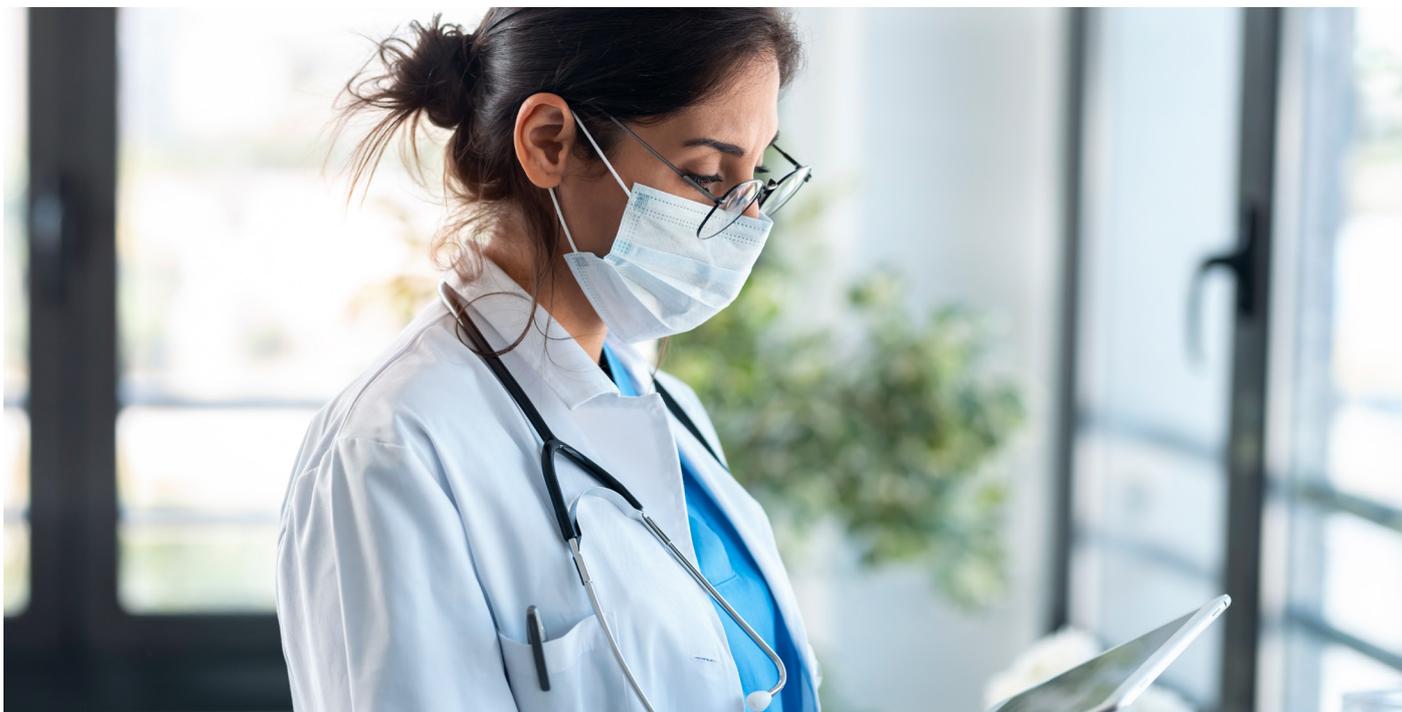
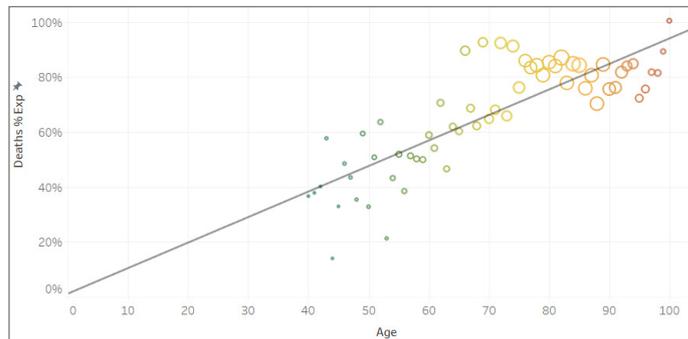
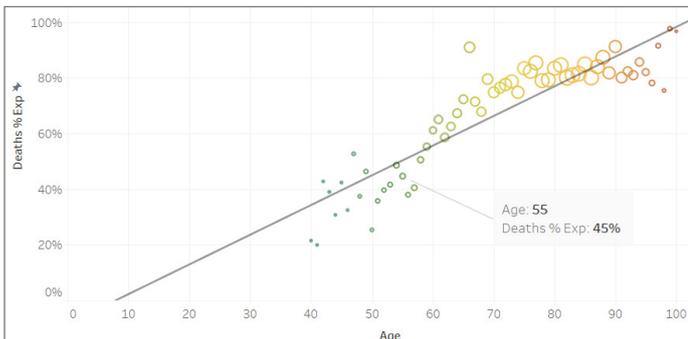
The CHKS model calibrated and applied to first wave March / April 2020 Covid-19 cases is shown below. In all the charts, males are on the left and females are on the right.



Using the same (first wave) model, second wave patients are plotted below. Note how the actual deaths (blue line) now sags below the model (orange line) for all ages.



This reduction in risk is not equal across ages. The relative reduction can be seen more easily below. While there was very little (only 10%) reduction in risk for the most elderly patients (over 95 years), the risk more than halved for those younger than 55 years old. For example, second wave 55-year-old males had only 46% of the deaths that would have occurred in the first wave. The trend appears linear and to continue with even younger age groups.



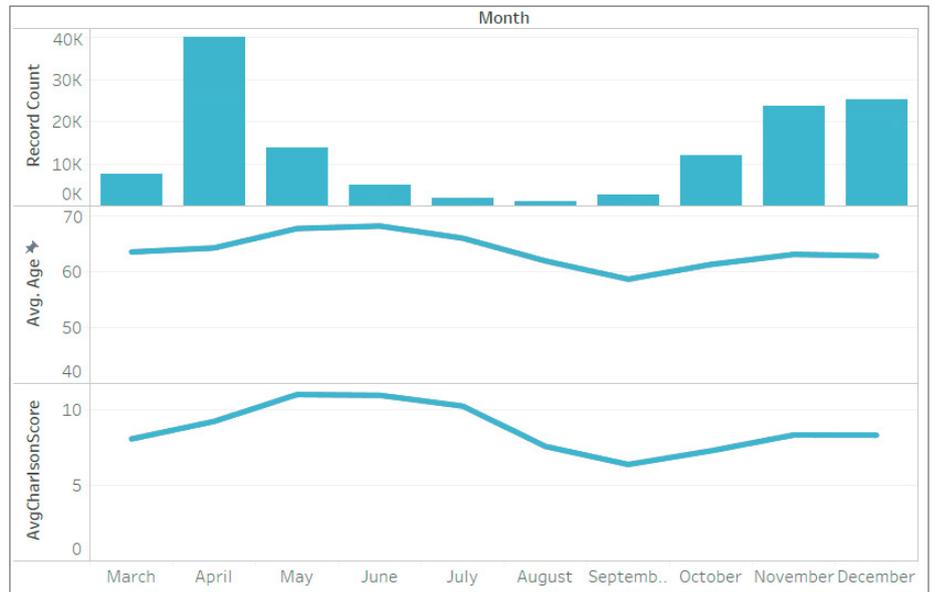
The model has clearly changed. Our current estimates for the coefficients underpinning each model (first and second waves) are given below.

Period	Males		Females	
	Risk (R)	Shape (P)	Risk (R)	Shape (P)
Mar-Jun 2020	40%	3.5	30%	3.3
Oct-Dec 2020	25%	4.7	19%	4.3

Source: CHKS Covid-19 mortality measure. Non-elective admissions England, Wales, NI with confirmed Covid-19 (U071) primary diagnosis.

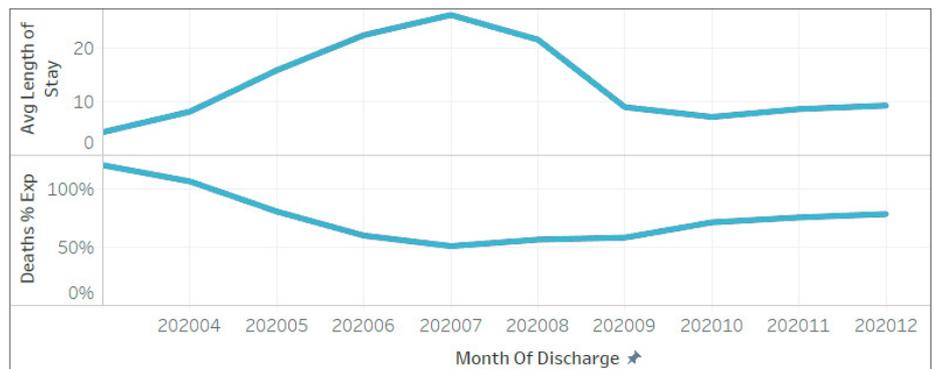
3. Reduced admission threshold during summer 2020

The average age and comorbidity (Charlson score) both reduced during the summer as patients feared going to hospital less and as health services had a little more space to care for less sick patients.



Source: CHKS Covid-19 mortality measure. Non-elective admissions England, Wales, NI with confirmed Covid-19 (U071) primary diagnosis.

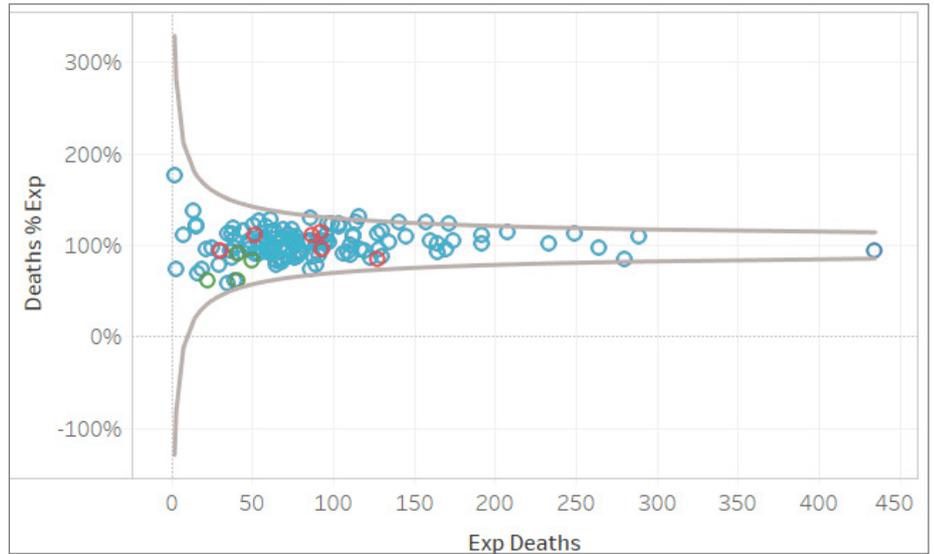
With more free beds and consequently less urgency to discharge patients, length of stay more than doubled. Case mix (age and sex) adjusted Covid-19 mortality was significantly lower during the summer.



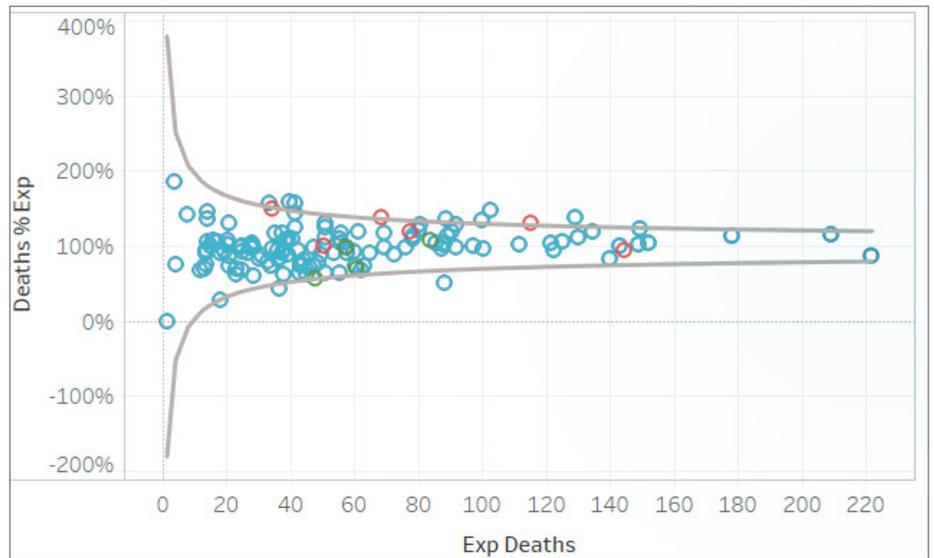
Source: CHKS analysis of non-elective admissions England, Wales, NI with confirmed Covid-19 (U071) primary diagnosis from CHKS DAT

4. Trusts may benchmark their performance using the CHKS Covid-19 mortality measure

Example funnel plots for males are shown below for first and second waves respectively. Few trusts lie outside the expected range, indicating relative consistency in performance across English, Welsh and NI trusts. The relatively tight distribution also suggests that the new measure appears to contain little ‘excess dispersion’, a problem which has dogged all general models of risk adjusted mortality.



Source: CHKS covid mortality measure. Non-elective admissions England, Wales, NI with confirmed covid-19 (U071) primary diagnosis. Males, March – May 2020.



Source: CHKS covid mortality measure. Non-elective admissions England, Wales, NI with confirmed covid-19 (U071) primary diagnosis. Males, Oct – Dec 2020

Next steps

- We are continuing to work with clients to understand their performance and compare to organisations experiencing similar pressures.
- Updating this analysis on receipt of January and February 2021 data.
- Recalibrating the CHKS Covid-19 Mortality model to account for the full second wave.
- Publishing our findings in a report in Spring 2021.

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