

Estimates of COVID-19 hospitalised mortality and length of stay: data from March 2020 to September 2021

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Summary

- Hospitalised case-fatality risk was elevated during periods of peak COVID-19 incidence and hospital demand (e.g. March 2020 and January 2021).
- Since March 2021, hospitalised case-fatality risk has been maintained at or below 10% and median lengths of stay in hospital have remained relatively stable.
- **After controlling for other factors, outcomes for single and double vaccinated patients were significantly improved compared to unvaccinated patients.**

Introduction

We apply competing risks methods to comprehensive public health surveillance data on patients hospitalised with COVID-19 in England between March 2020 and September 2021. Hospital-onset COVID-19 cases were excluded.

Primary data sources were the Secondary Uses Service (SUS) dataset, linked to the emergency Care Dataset for England (ECDS). Complete information on deaths and vaccination was obtained through linkage to the UKHSA deaths and National Immunisation Management Service (NIMS) datasets.

Two complementary statistical analyses were undertaken to understand both the absolute and relative risks of hospitalised fatality. Aalen-Johansen cumulative incidence estimation was used to obtain estimates of cumulative hospitalised case-fatality risk (HFR) and median lengths of stay in hospital for specific sub-sets of the population, unadjusted for other factors. Stratified Fine-Grey competing risk regression with adjustment for confounders was used to estimate the association of each risk factor with the cumulative incidence of hospitalised fatality.

Variables considered in the regression analysis included: month of admission, vaccination status, age group, region of residence, sex, ethnicity, deprivation (IMD quintile), hospital load and baseline Charlson comorbidity index (CCI).

Hospitalised case-fatality risk

Among a total of 259,727 individuals hospitalised with COVID-19, 51,948 (20.0%) experienced mortality in hospital, with the remainder being discharged or remaining in hospital at the end of September 2021.

Figure 1 presents monthly HFR estimates. HFR decreased during the first wave of the pandemic from 40.3% (95% confidence interval: 39.4 - 41.3%) in March 2020 to 12.3% (10.3 - 14.8%) in August 2020. During the second wave HFR increased to a peak of 22.8% (22.5 - 23.2%) in January 2021, although by March 2021 had halved to 10.5% (9.7 - 11.4%) and was maintained at or below 10% throughout subsequent months.

Length of stay

Median time to discharge decreased throughout the first wave, from 5.9 (5.8 - 6.0) days in March 2020 to 3.1 (2.9 - 3.3) days in August 2020. Median time to discharge peaked again at 5 (5 - 5.1) days in December 2020, before falling to 2.7 (2.6 - 2.8) days by June 2021. (Figure 1)

Meanwhile, median stay prior to death increased from 5.6 (5.5 - 5.6) days to 9.9 (9.2 - 10.9) days between March 2020 and August 2020, shortened to 7.5 (7.5 - 7.6) days in January 2021, and lengthened to 10.4 (10.1 - 10.8) days by June 2021. (Figure 1)

Hazard of hospitalised fatality

The hazard ratio for hospitalised fatality was increased during March to May 2020, September 2020 to February 2021, and June to September 2021, as compared to June 2020. (Figure 2)

The hazard ratio for mortality following hospital admission was 0.72 (0.67 - 0.77) among those admitted >21 days post first vaccine, and 0.58 (0.54 - 0.62) for those admitted >14 days post second vaccine, compared to a reference category of unvaccinated (Figure 3).

Hazard ratios for hospitalised fatality were greater for those of Asian (1.19 (1.15 - 1.23)) and Mixed/Other/Unknown ethnicity (1.06 (1.01 - 1.12)) compared to White. Males had a greater hazard compared to females (1.29 (1.27, 1.32)), and compared to no comorbidities those with a higher burden of comorbidity had a greater hazard of hospitalised mortality (3.1 (2.98 - 3.22) for CCI of 5 or above). Those residing in more deprived quintiles had greater hazards for hospitalised mortality (1.13 (1.09, 1.16) for the most deprived quintile) compared to a reference of least deprived. (Figure 4)

Hazards ratios increased with increased hospital load, to 1.23 (1.17 - 1.28) for load at 80-90% of the busiest week and 1.21 (1.16 - 1.27) for load at 90-100% of the busiest week (compared to 0-20% load). (Figure 4)

Interpretation

The prognosis for patients hospitalised with COVID-19 in England has varied substantially throughout the pandemic and is confounded with age, sex, region, ethnicity, deprivation, baseline comorbidity, vaccination status, and hospital load at admission.

The reduction in HFR during early-2021 is estimated against a backdrop of national lockdown restrictions, reduced hospital load, and very high uptake of COVID-19 vaccines among those in the oldest two age groups. Changes in outcomes of patients admitted to hospital should continue to be closely monitored as subsequent vaccine doses are rolled out and new variants emerge.

Figure 1: Hospitalised fatality risk and median length of stay by month of admission. Estimated by Aalen-Johansen cumulative incidence estimator, for the competing outcomes of death and discharge. Error bars are 95% confidence intervals.

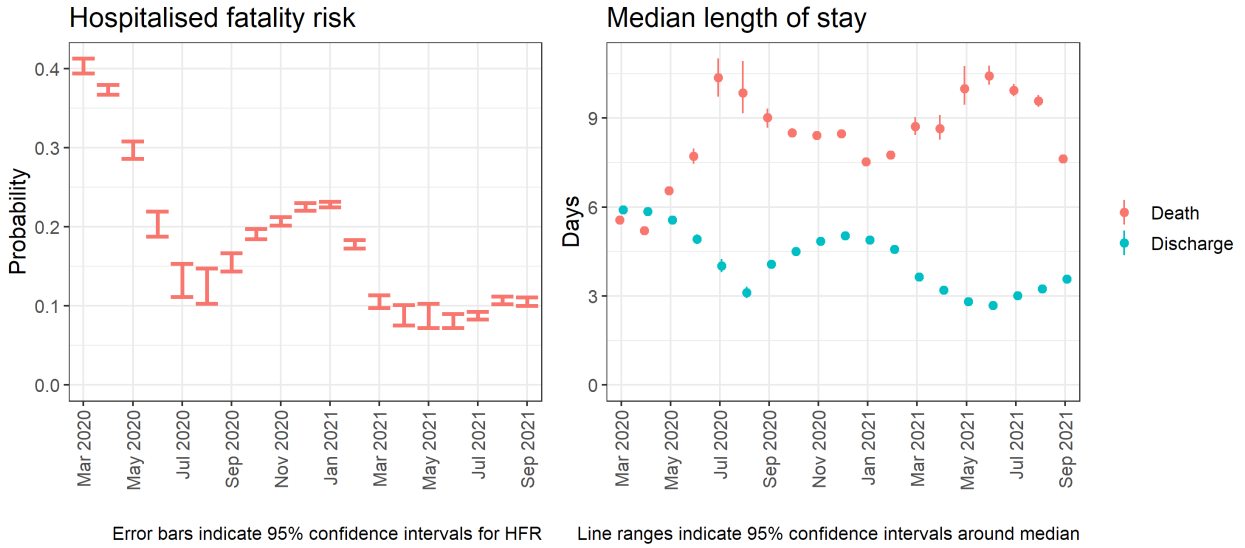


Figure 2: Hospitalised fatality sub-distribution hazard ratio by month of hospital admission, stratified by age group, region of residence and vaccination status, with regression adjustment (main effects) on sex, ethnicity, IMD quintile, hospital load, and CCI. Reference group: June 2020.

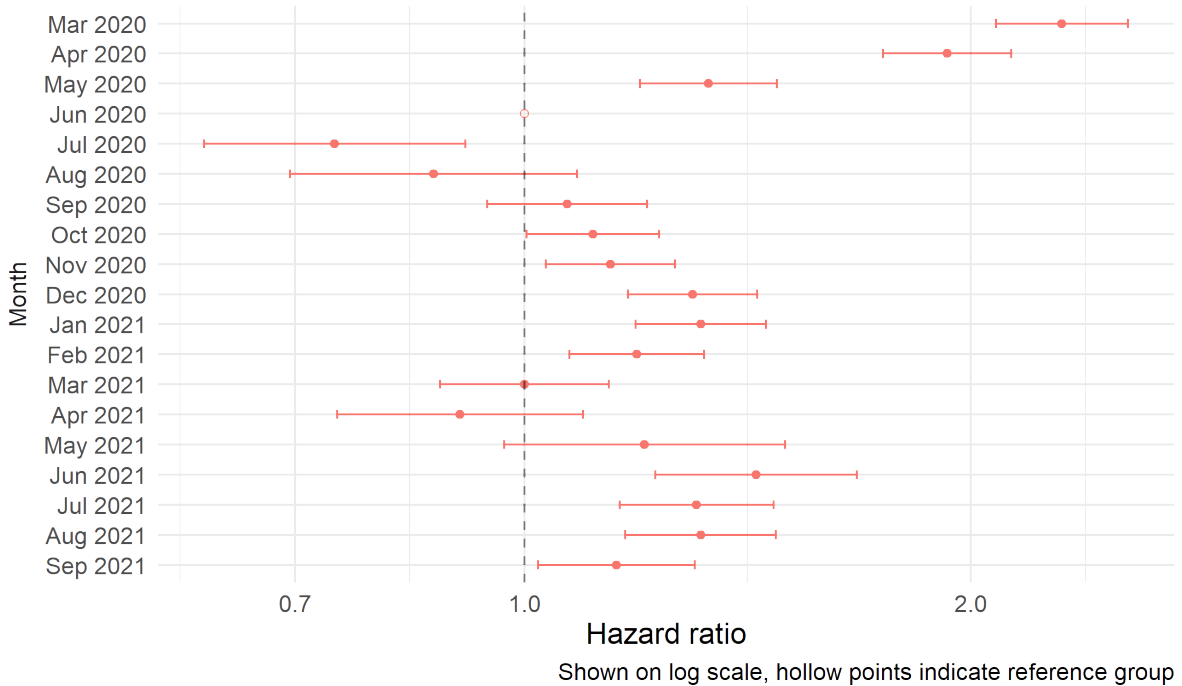


Figure 3: Hospitalised fatality sub-distribution hazard ratio by vaccine status for January-September 2021, stratified by age group, region of residence and month of hospital admission, with regression adjustment (main effects) on sex, ethnicity, IMD quintile, hospital load, and CCI. Reference group: Unvaccinated.

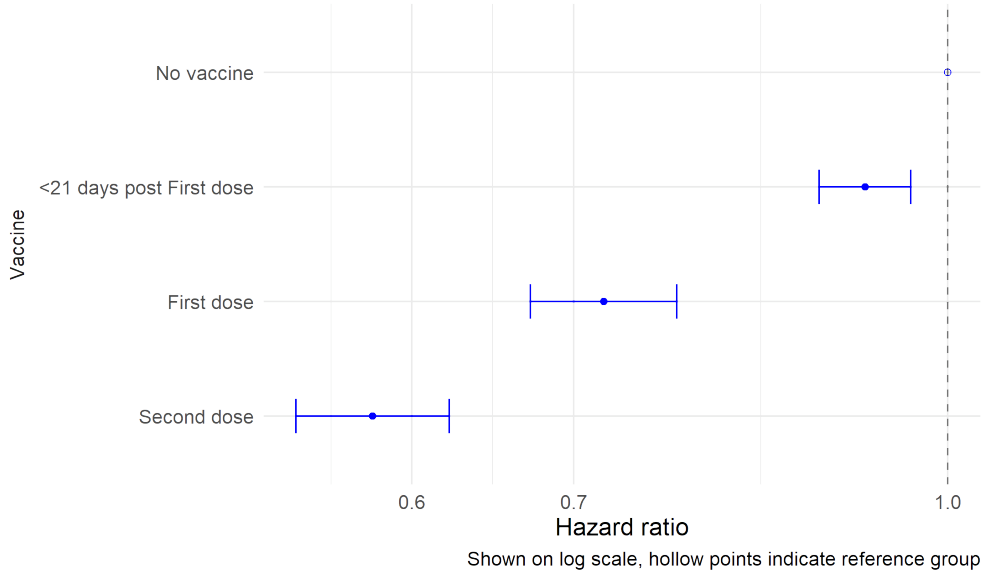


Figure 4: Hospitalised fatality sub-distribution hazard ratios for sex, ethnicity, IMD quintile, hospital load and CCI, stratified by age group, region of residence and vaccination status, with regression adjustment (main effects) on month of admission (shown in Figure 2).

