Hospital-acquired SARS-CoV-2 infection in UK

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Preventing hospital acquired infections (HAIs) is a critical aspect of clinical management of SARS-CoV-2; HAIs have been a common feature of previous novel coronavirus outbreaks.[1] COVID-19 patient numbers are once again high in UK hospitals, so it is timely to assess the magnitude of nosocomial COVID-19 in acute and long-term NHS hospital facilities in the United Kingdom during the first epidemic wave.

We examined records of COVID-19 patients in UK hospitals enrolled in the International Severe Acute Respiratory and emerging Infections Consortium (ISARIC) World Health Organization (WHO) Clinical Characterisation Protocol UK (CCP-UK) study, with symptom onset before 1st August 2020.[2,3] We identified patients as HAIs using a combination of their admission date and symptom onset date, and estimates of their infection date based on the known incubation period distribution of SARS-CoV-2.[4] To incorporate uncertainty in individual patient's incubation periods, we imputed infection dates for patients and identified those admitted prior to infection as HAIs. Multiple imputation was used to generate estimates and confidence intervals (see Figure and Supplementary Material). We estimate that at least 11.1% (mean 11.3%, 95%CI 11.1 to 11.6) of COVID-19 patients in 314 UK hospitals were infected after admission. This proportion increased to at least 15.8% (mean 17.6%, 95%CI 15.8 to 19.6) in mid-May 2020, long after the peak of admissions. Using an extremely conservative threshold of symptom onset at least 14 days after admission to identify HAIs, we estimate 6.8% of all patients were nosocomial (95%CI 6.7 to 7.0), and 8.2% of patients at the mid-May peak (95%CI 7.0 to 9.6).

There was marked heterogeneity in HAI proportion between hospital trusts and by the nature of care they provide (see Figure). Hospitals providing acute and general care had lower HAI proportions (9.7%, 95%CI 9.4 to 9.9) than residential community care hospitals (61.9%, 56.4 to 68.0) and mental health hospitals (67.5%, 60.1 to 75.8), reflecting outbreaks seen in care-homes. The reasons for the variation between hospitals providing the same type of care require urgent investigation to identify and promote best infection control practice for future treatment of COVID-19 patients.

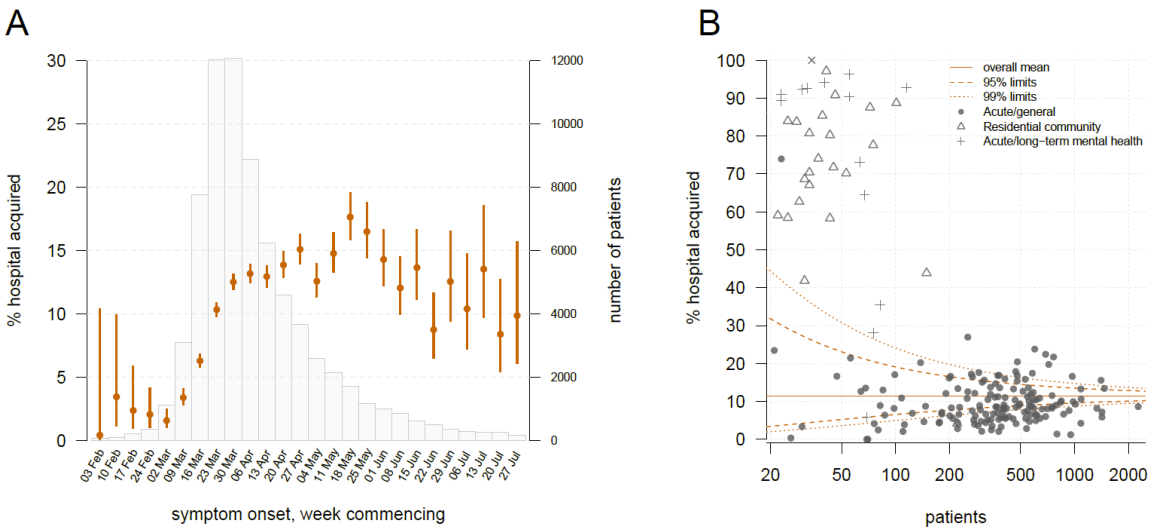
As ISARIC WHO CCP-UK data are a subset of all admissions (approximately 2/3rds sample in the period of observation) we estimated the number of HAIs by hospital trust, accounting for the participation rate of each hospital trust in comparison to NHS Digital Secondary Uses Service data. We estimated of 82,624 patients admitted before 1st August 2020, between 5,699 and 11,862 patients were infected during their stay. Underestimation is likely since

ISARIC4C data cannot identify patients infected during admission but discharged before manifesting symptoms, or patients infected during another healthcare visit before admission.

Limited access to testing early in the outbreak, false negative results for nasopharyngeal swabs in early stages of disease, and presentation with gastrointestinal symptoms may have led to some patients with COVID-19 being misclassified and placed in non-COVID-19 areas with different infection prevention control processes.[3] Enteric features, and the ability of SARS-CoV-2 to persist on surfaces, raise the possibility of faecal-oral transmission in care settings under severe pressure, although the role of this transmission route is uncertain.[5]

Going forward, it is critical to minimise the HAI burden using the lessons learned this past year and consider new approaches to reduce this further. Surveillance afforded by this study has helped to rapidly identify changes in HAI incidence in different healthcare settings. Unlike at the beginning of the pandemic, there are opportunities to pre-empt HAI and break chains of transmission through regular patient, resident and staff testing including point-of-care diagnostics, as recently introduced for NHS staff, coupled with robust hospital infection prevention and control policies that include staff vaccination, environmental disinfection, and appropriate isolation, all supported by sentinel monitoring systems.

Figure



(**A**) Estimated proportion of COVID-19 patients with hospital acquired infection based on 72,157 patients with complete admission and symptom onset dates, imputing HAI status based on known incubation period; this imputation was repeated 500 times and the uncertainty incorporated into confidence intervals. Red dots and lines are the weekly HAI mean proportion and 95% confidence intervals; grey bars are the corresponding number of enrolled patients with symptom onset in each week. (**B**) Funnel plot of trust-level proportion of HAI, stratified by care type. The mean HAI proportions is shown as a solid red line, with dotted lines representing 95% and 99% confidence intervals, adjusted for the number of ISARIC4C patients per hospital trust enrolled with complete admission and symptom onset information.

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Declaration of interests

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