Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

COVID-19 susceptibility in long-term care facilities

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Disease outbreaks in long-term care facilities (LTCFs) have been a large driver of morbidity and mortality during the COVID-19 pandemic. This susceptibility to outbreaks in LTCFs is likely to be multifactorial, including frailty of residents, structural and environmental characteristics of buildings (eg, shared spaces, ventilation, and outdoor access), staffing policies and models, and the value society places on older people and LTCFs.[1] Understanding of the true burden of COVID-19 in LTCFs has been limited by gaps in measurement and reporting. The impact of COVID-19 has evolved during subsequent pandemic waves, but estimates suggest that internationally more than 40% of deaths have occurred among residents of LTCFs,[2] with many national and local estimates indicating a much higher death toll. Additionally, LTCF staff have been greatly affected as frontline workers.[3,4] Patterns of vulnerability to SARS-CoV-2 infection and transmission within LTCF environments are thus crucial to addressing the pandemic at both clinical and policy levels. In *The Lancet Healthy Longevity*, Maria Krutikov and colleagues[5] studied the incidence of SARS-CoV-2 reinfection according to baseline antibody status in staff and residents in 100 LTCFs in England. Their findings make an important contribution to ongoing efforts to understand SARS-CoV-2 immunity and correlates of protection.

The authors enrolled 682 LCTF residents from 86 LCTFs and 1429 staff from 97 LCTFs, and did three rounds of nucleocapsid and spike protein IgG antibody testing in June, August, and October, 2020. From Oct 1, 2020, participants were monitored for reinfection using regular PCR tests done on a routine basis in these populations (weekly for staff and monthly for residents). Data were linked to results from the UK national testing programme (using National Health Service [NHS] number) and a Care Quality Commission location identifier for each LTCF. No individual-level health data were reported other than antibody titres, testing data, and symptoms in case of illness. Analyses were adjusted for age and sex, and stratified by LCTF and region. At baseline, IgG antibodies to nucleocapsid were identified in 226 (33%) of 682 residents and 408 (29%) of 1429 staff members; 39 (17%) of the 226 residents and 102 (25%) of 408 staff members who were antibody-positive at baseline tested antibody-negative at a later round of testing. The risk of reinfection was substantially lower for residents who were antibody-positive at baseline than residents who were antibody-negative at baseline (adjusted hazard ratio [aHR] 0·15 [95% CI 0·05–0·44]), with the same pattern observed in staff members (aHR 0·39 [0·19–0·82]). Ten members of staff and four residents were re-infected; nearly all were symptomatic, although the profile of symptoms seemed to differ between residents and staff members, whereby more residents reported fever and more staff reported coughs. The authors acknowledged that the difference in testing frequency between staff and residents could have led to underascertainment of asymptomatic infections, particularly for residents and also any staff who were not tested weekly. The authors concluded that the risk of infection was substantially lower in residents and staff who had baseline antibody positivity; it seems that this protective immunity conferred by previous infection reduced the risk of reinfection by approximately 85% for residents and 61% for staff.

This study by Krutikov and colleagues has many strengths. The study included a large sample across 100 facilities in a context of high levels of community transmission of SARS-CoV-2. SARS-CoV-2 testing protocols and measures of humoral immunity were robust. Linkage of records was possible for many study participants, although some participants (who were mainly staff members) could not be linked, which introduced some potential for bias. Viral genome sequencing was not reported, thus the impact of variants of concern on reinfection remains unclear. Other study limitations include absence of other measures of individual health status (such as comorbidities and frailty) and reliance on measures of antibody titres versus cell-mediated immunity.

Correlates of immunity for SARS-CoV-2 are yet to be defined, and are particularly unclear for older adults who often have dysregulated patterns of humoral and cell-mediated immunity compared with more frequently described younger populations. In this study, antibody levels were the only measure of immune response. Considering the increasingly recognised importance of cell-mediated immunity in responses to viral infections, including SARS-CoV-2, in older adults,[6] future studies will ideally include assays of cell-mediated immunity to investigate whether patterns of protection vary between humoral and cell-mediated immunity. In order to understand immune responses and protection from severe

outcomes and reinfection, the immune responses (humoral and cell-mediated immunity) and other host features of vulnerability to disease or resilience must be understood.[7,8] The influence of frailty and comorbidity on, and in relation to, immune responses remains to be understood and will be important foci of further study.

The study by Krutikov and colleagues also provides the opportunity to consider the importance of facility-level and policy factors for SARS-CoV-2 outbreaks in LTCFs.[9] All of the facilities included in the reporting of the study to date were privately owned by a single health-care group. As data emerge on the differences in transmission rates and outcomes of COVID-19 in LTCFs with different physical characteristics and organisational, funding, and profit models, it is clear that facility-level factors will need to be assessed to inform efforts to improve care in LTCFs.

Addressing the susceptibility of LTCF environments, residents, and staff members to COVID-19 outbreaks will require a concerted effort to understand the many factors underlying immune responses and health status, including host vulnerability to disease, and the structural and policy considerations at facility and jurisdictional levels.[10] The findings of Krutikov and colleagues contribute important knowledge to this effort. Crucial next steps also include further understanding of the association between frailty and immune regulation and the assessment of immune responses to vaccines in LTCF populations. Ongoing efforts are needed to better protect the health and wellbeing of LCTF residents and staff members.

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