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# Increased risk of SARS-CoV-2 infection in staff working across different care homes: enhanced CoVID-19 outbreak investigations in London care Homes

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SUMMARY

*Background:* Care homes have been disproportionately affected by the COVID-19 pandemic and continue to suffer large outbreaks even when community infection rates are declining, thus representing important pockets of transmission. We assessed occupational risk factors for SARS-CoV-2 infection among staff in six care homes experiencing a COVID-19 outbreak during the peak of the pandemic in London, England.
*Methods:* Care home staff were tested for SARS-COV-2 infection by RT-PCR and asked to report any symptoms, their contact with residents and if they worked in different care homes. Whole genome sequencing (WGS) was performed on RT-PCR positive samples.
*Results:* In total, 53 (21%) of 254 staff were SARS-CoV-2 positive but only 12/53 (23%) were symptomatic. Among staff working in a single care home, SARS-CoV-2 positivity was 15% (2/13), 16% (7/45) and 18% (30/169) in those reporting no, occasional and regular contact with residents. In contrast, staff working across different care homes (14/27, 52%) had a 3.0-fold (95% CI, 1.9–4.8; $P<0.001$) higher risk of SARS-CoV-2 positivity than staff working in single care homes (39/227, 17%). WGS identified SARS-CoV-2 clusters involving staff only, including some that included staff working across different care homes.
*Conclusions:* SARS-CoV-2 positivity was significantly higher among staff working across different care homes than those who were working in the same care home. We found local clusters of SARS-CoV-2 infection between staff only, including those with minimal resident contact. Infection control should be extended for all contact, including those between staff, whilst on care home premises.
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## Introduction

Care homes have been disproportionately affected by coronavirus disease 2019 (COVID-19) with high rates of severe illness and deaths among the vulnerable residents with multiple co-morbidities. Detailed investigations of care homes experiencing a

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COVID-19 outbreak identified high rates of SARS-CoV-2 positivity among residents and staff, most of whom were asymptomatic at the time of testing.[1–3] In England, the first imported cases of COVID-19 were reported at the end of January 2020 and autochthonous transmission was confirmed a month later.[4] Cases began to increase rapidly from early March and peaked in mid-April before plateauing and then declining. London was one of the earliest and worst affected cities in England and large outbreaks of COVID-19 were reported in care homes during the peak of the pandemic.[4] By May 01, 2020, there had been excess of 22,000 deaths among care home residents during the COVID-19 pandemic, accounting for 54% of all the excess mortality in England and Wales.[5]

During the weekend of April 10, 2020, Public Health England (PHE) conducted detailed investigations in six London care homes experiencing a COVID-19 outbreak. Most of the care homes had implemented extensive infection control and prevention practices, including widespread use of personal protective equipment, isolation of symptomatic residents, restriction of communal gatherings, being closed to new resident admissions, strict restrictions to visitors and self-isolation of symptomatic staff. We hypothesised that understanding infection and transmission among staff may identify additional interventions that may help protect vulnerable residents in care home settings. We, therefore, assessed occupational risk factors for SARS-CoV-2 infection among staff in the six London care homes, focussing specifically on associations with the degree of exposure to residents and working across different care homes.

## Methods

Six London care homes reporting a suspected outbreak (≥2 suspected cases) of COVID-19 to Public Health England during April 10–13, 2020 were investigated. These were mainly nursing or mixed nursing/residential homes of different sizes, providing care for 43–100 residents with 20–130 staff. Staff working during the investigation days provided a nasal self-swab which was tested for SARS-CoV-2 by real-time reverse transcription (RT) PCR assay on an Applied Biosystems 7500 FAST system targeting a conserved region of the open reading frame (ORF1ab) gene of SARS-CoV-2, together with an internal control.[6] Whole genome sequencing (WGS) was performed on all RT-PCR positive samples.[7] Staff were asked to report any symptoms, their contact with residents and if they worked in different care homes.

## Results

Across the six care homes experiencing a COVID-outbreak, 254 of 474 (54%) staff members were working during April 10–13, 2020, and provided a nasal swab and 53 (21%) tested positive for SARS-CoV-2, including 12 (23%) who were symptomatic at the time of swabbing. SARS-CoV-2 positivity was 15% (2/13), 16% (7/45) and 18% (30/169) among staff working in a single care home who reported no, occasional and regular contact with residents (Fig. 1). In contrast, SARS-CoV-2 positivity was 47% (7/15) among permanent staff who had regular contact with residents and occasionally worked across different care homes, while 58% (7/12) of staff with regular resident contact who frequently worked across different care homes. Compared to staff working in a single care home (39/227, 17%), those working in different care homes (14/27, 52%) had a 3.0-fold (95% CI, 1.9–4.8; $P<0.001$) higher risk of SARS-CoV-2 positivity.

All positive samples underwent WGS analysis and samples from 61 residents and 31 staff distributed across all care homes yielded sufficient sequence for analysis. In care homes experiencing large outbreaks, there were multiple introductions of the virus into individual care homes and evidence of clustering between staff and residents (light blue, red, purple) which would support cross-infection in individual care homes (Fig. 2). Within the small cohort of SARS-CoV-2 positive staff, genomic analysis identified two pairs of samples that were not separated when placed in the context of the background of SARS-CoV-2 genomic samples from across greater London (COVID-19 Genomics UK Consortium: https://www.cogconsortium.uk/) dataset ($n=27,768$), indicating a higher likelihood of transmission between the individuals. The individual clusters involved at least one member of staff and there were several clusters that only involved staff within the same care home. The staff-only paired samples involved those working in single care homes (Fig. 2, blue highlight), including those with only occasional or no contact with residents (Fig. 2, green highlight). One pair of identical sequences was separated on comparison with the large background set, reducing the likelihood of transmission between these individuals. There was one other staff member present in the large cluster from care home D who reported no contact with residents but formed part of a large cluster ($n=28$) that included other SARS-CoV-2 positive staff. A putative cluster involving staff from care home A (highlighted in red) was not present when these sequences were compared with the COG dataset, suggesting that transmission between care home staff was unlikely in this case.

## Discussion

In six London care homes experiencing a COVID-19 outbreak during the peak of the pandemic, 21% of staff tested positive for SARS-CoV-2 and, of those positive, only 23% were symptomatic at the time of testing. Within this group, 15–18% of staff working in a single care home were infected with SARS-CoV-2 during the peak, which compares with 17.5% community sero-prevalence in London at that time.[8] SARS-CoV-2 infection among staff working across different care homes, however, was 3-fold higher. WGS of all positive strains provided useful information on the strains responsible for the outbreaks and, while directionality of infection cannot be inferred form WGS analysis, we did find evidence of SARS-CoV-2 clusters involving staff only, including some that included staff working across different care homes and others with staff reporting minimal contact with residents.

In a recent review of evidence to stop pandemics spreading across care homes, the centre for Evidence Based Medicine identified 30 studies on viral infection control, relating mainly to influenza, in care homes.[9] In addition to hand washing, environmental decontamination, restricted visitation and rapid testing, the review recommended that allocating staff to one facility consistently may reduce spread across several locations but the evidence supporting this recommendation was indirect and limited. Care home staff are known to have multiple jobs, including working across different care homes and other healthcare facilities. In a recent US survey, 17% of care home staff had a second job and more than 60% held double- or triple-duty care-giving roles.[10] Additionally, in many countries including the UK and the US, care homes are heavily reliant on temporary “bank” or agency staff to provide cover for their staff in case of shortages or sick leave.[11,12] Staff are also recognised sources of infection, especially respiratory and gastrointestinal viruses, in care homes,[13] and COVID-19 is no exception.[14,15] In a recent care home outbreak in King County, Washington State, US, a health care provider was identified as the index case who might have contributed to rapid spread in one of the facilities.[14] Similarly, in Ontario, the strongest predictor of death in residents was SARS-CoV-2 infection in a staff member in the previous week.[15]

Modelling simulations have found that staff are a key source of outbreaks and transmission in care homes; in particular, the modelling identified staff re-entry into care homes as the critical path-

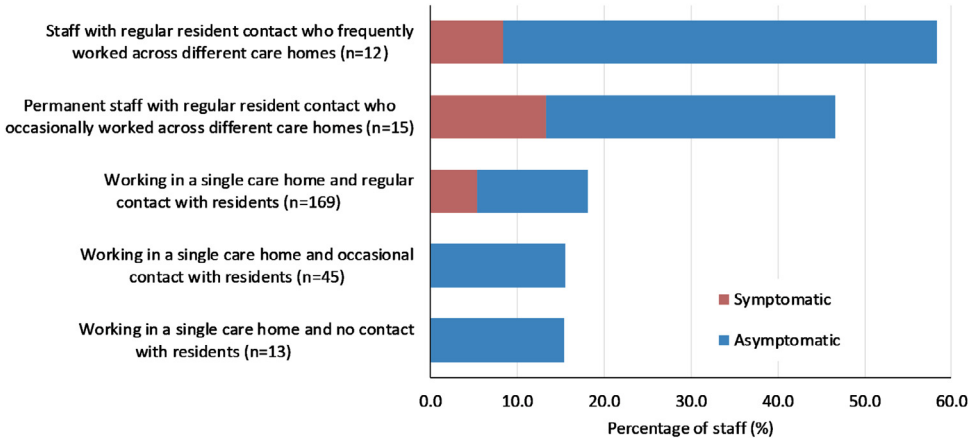



**Fig. 1.** SARS-CoV-2 positivity among symptomatic and asymptomatic care home staff in 6 London care homes experiencing a COVID-19 outbreak.



**Fig. 2.** Maximum Likelihood phylogeny of 99 SARS-CoV-2 genomes from individuals within 6 London care homes. Coloured branches are used to indicate the care home, staff are annotated on the tree with (S), genomes from patients who died after testing positive for covid-19 are shown with (X). Unannotated tips in the phylogeny represent genomes from care home residents. P=permanent staff; R=regular contact with residents; O=occasional contact with residents; N=no contact with residents; Y=occasionally working across care homes; A=regularly working across care homes.

way for contagion.[11] That model suggested that limiting the potential for staff exposure to the virus in the community, through virtually complete facility isolation or at least 10 days in continuous residence at the facility for example, significantly reduced the risk of virus introduction into the care home, although these measures were considered socially unworkable.[11]

Working across different care homes could potentially increase the risk of introducing SARS-CoV-2 into the care home. Given the high rates of asymptomatic infection with SARS-CoV-2, the virus could spread rapidly among residents and staff before symptoms appear and an outbreak is declared.[3] We found significantly higher SARS-CoV-2 infection rates among staff who worked in different care homes and this risk increased with the frequency of working across care homes, where nearly 60% tested positive for SARS-CoV-2. Given that stringent infection control practices, including closure to visitors, were reported to be in place by the time of testing, staff working across care homes (most of whom were asymptomatic at the time of testing) were, therefore, a significant potential source and reservoir of SARS-CoV-2. Reassuringly, this cohort accounted for only 11% of the tested workforce.

Within individual care homes, we also identified similar SARS-CoV-2 infection rates among staff with different exposures to the residents, including those who reported no contact with residents. This is consistent with provisional data from a recent national survey in England which reported no difference in SARS-CoV-2 positivity between patient-facing healthcare workers, resident-facing social care staff and those not working in these roles.[16] Genomic analysis identified staff-only clusters, including clusters between resident-facing and non-resident facing staff, supporting staff to staff transmission. However, although identical viruses were identified in staff working in different care homes, WGS analysis could not distinguish whether this might have arisen by community transmission due to the low genetic diversity amongst circulating viruses.

The staff members put themselves at increased risk of COVID-19 and their risk of severe disease may be increased by pre-

existing health condition; care workers have among the highest mortality rates among all occupations.[17,18] Infected care home workers also put their household members at risk of COVID-19 and, depending on the careers of the household members potentially contribute to ongoing transmission in the community.

Finally, we identified a proportion of SARS-CoV-2 positive staff members, especially among those working across different care homes, who were symptomatic at the time of testing (Fig. 1). A recent study reported that more than 70% of care home staff felt obligated to come to work even when they were sick.[10] This problem of presenteeism has the potential to jeopardise the health of the residents, other staff, visitors and household members. In addition to implementing stringent infection control practices, facilities could help mitigate this risk by increasing wage, providing incentives for working in single care homes, and offering sick leave and benefits especially for the lowest wage workers, as has been recommended by others. [10-12]

## Strengths and limitations

The strength of this surveillance is the large numbers of residents and staff tested at the same time across six London care homes during the peak of the COVID-19 pandemic. We were already reported the high rates of asymptomatic infection in residents and staff at the time of testing and the high case fatality rates (35%) among symptomatic SARS-CoV-2 positive residents compared to asymptomatic SARS-CoV-2 positive as well as the SARS-CoV-2 negative residents in the same care homes. A limitation of this analysis was that, although we achieved a 100% response rate, some staff may not have wished for their employers to know if they worked in different care homes. This, however, would only serve to widen the difference in SARS-CoV-2 positivity rates between staff working in single care homes compared to those working across different care homes. We were also unable to identify the source of infection among the staff, which could have been acquired from the community, from the residents or from other staff working in the care homes.

## Conclusions and implications

We identified very high rates of SARS-Cov-2 infection in staff working across different care homes compared to those who were working in the same care home. Staff should be encouraged and incentivised to work in single care homes and movement of staff across multiple care homes should be limited. Where necessary, temporary care home staff need to be fully inducted into any new working environment, including infection prevention control measures, and regular testing for SARS-CoV-2 should be considered. We also found local clusters of SARS-CoV-2 infection between staff only in some care homes. Infection prevention and control measures should not be restricted to contact with residents but needs to be extended for all contact, including those between staff, whilst on care home premises.

## Declaration of Competing Interest

None.

## Ethics approval

This investigation was conducted as part of Public Health England's responsibility to investigate infectious disease outbreaks during the COVID-19 pandemic

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