

No cases of asymptomatic SARS-CoV-2 infection among healthcare staff in a city under lockdown restrictions: lessons to inform 'Operation Moonshot'

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ABSTRACT

Background Leicester was the first city in the UK to have 'local lockdown' measures imposed in response to high community rates of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) transmission. As part of this response, a directive was issued by NHS England to offer testing of asymptomatic healthcare workers (HCWs) at University Hospitals of Leicester NHS Trust (UHL) for SARS-CoV-2 infection.

Methods Between 20 July and 14 August 2020, we invited all HCWs at UHL to attend for SARS-CoV-2 testing by nucleic acid amplification (NAAT). We combined the result of this assay with demographic information from the electronic staff record.

Results A total of 1150 staff (~8% of the workforce) volunteered. The median age was 46 years (IQR 34–55), 972 (84.5%) were female; 234 (20.4%) were of South Asian and 58 (5.0%) of Black ethnicity; 564 (49.0%) were nurses/healthcare assistants. We found no cases of asymptomatic infection. In comparison, average community test positivity rate in Leicester city was 2.6%.

Conclusions Within the context of local lockdowns due to high community transmission rates, voluntary testing of asymptomatic staff has low uptake and low yield and thus its premise and cost-effectiveness should be re-considered.

Keywords asymptomatic, COVID-19, healthcare worker, lockdown, SARS-CoV-2

Introduction

At present, coronavirus disease 2019 (COVID-19) national hospital caseload and mortality rate in the UK is increasing.¹ In response, the UK Government adopted a strategy of imposing regional lockdowns in areas with high rates of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and has signalled its intent to return to this strategy after the country-wide lockdown that began on 5 November 2020 has been lifted.²

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SARS-CoV-2 transmission. These measures, which include stringent social distancing and enhanced testing, tracing and public health messaging, were brought into force on 29 June 2020 and remained in place until the start of the countrywide lockdown.

Once local lockdown was declared and large-scale community testing was initiated in Leicester, a directive was issued by NHS England to offer SARS-CoV-2 testing to asymptomatic healthcare workers (HCWs).

In this context, we conducted cross-sectional surveillance to determine the prevalence of asymptomatic SARS-CoV-2 infection among HCWs at University Hospitals of Leicester (UHL) NHS Trust during the local lockdown.

Methods

Between 20 July and 14 August 2020, we invited all HCWs (including ancillary staff) by email to attend for a nasopharyngeal swab, which was subsequently analysed in the UHL microbiology laboratory by nucleic acid amplification using the Aptima[®] SARS-CoV-2 Assay (Panther[®] System, Hologic).

We combined nucleic acid amplification test (NAAT) results with information on age, gender, ethnicity, occupational role and speciality obtained from the electronic staff record. We used residential postcodes to obtain the Index of Multiple Deprivation quintile (a measure of deprivation for small areas of England), using an online tool provided by the UK government.³ We also determined the number of staff with a residential postcode in the LE2 area, an area with comparatively high rates of community transmission.

All continuous variables were non-normally distributed and are summarized as median and interquartile range (IQR), categorical variables are summarized as count and percentage.

This service evaluation was approved as surveillance by the Tactical Command meeting of University Hospitals of Leicester (Reference Number PCRAST).

Results

Results are shown in Table 1. Of a total workforce of more than 15 000 staff,⁴ 1150 (~8%) volunteered for screening. The median age was 46 years (IQR 34–55), and 972 (84.5%) were female; 234 (20.4%) were of South Asian and 58 (5.0%) of Black ethnicity; 42 (3.7%) were employed as doctors, and 564 (49.0%) were nurses/healthcare assistants (HCAs). For comparison, across UHL 77% of staff are female and 36.2% are of minority ethnicity. A total of 13.5% are employed in medical or dental roles, and 45.1% are employed in registered

nursing/midwifery roles or clinical support roles (including HCAs).⁴

Of the 1150 staff who were tested, none had a positive NAAT test. Local public health figures show the average weekly positivity rate in Leicester city over the 4 weeks of our surveillance was 2.6%.

Discussion

Main finding of this study

In this large, ethnically and occupationally diverse sample of asymptomatic hospital staff, including a significant number who reside in an area of the city with particularly high rates of transmission, we found no cases of asymptomatic SARS-CoV-2 infection.

What is already known on this topic

There is evidence to suggest that healthcare workers (HCWs) face a higher risk of SARS-CoV-2 infection than the general population.⁵ Recent work conducted in a population of HCWs at UHL has demonstrated anti-SARS-CoV-2 IgG (a marker of prior SARS-CoV-2 infection) seroprevalence to be ~11.0%; higher than estimated community seroprevalence rates at the time of the study.⁶ Such observations raise the possibility that infected HCWs may pose a risk to their colleagues, community contacts and patients. Indeed, previous work has demonstrated nosocomial transmission of SARS-CoV-2 to be responsible for 12.5% of hospital COVID-19 cases.⁷ Compounding these concerns is the observation that a significant proportion of those infected with SARS-CoV-2 may be asymptomatic/pre-symptomatic, and this may be more likely in a younger population (such as those actively employed).⁸ This has led to calls for routine screening of asymptomatic staff for SARS-CoV-2,⁹ although such programmes have produced variable results. A UK study at the peak of the pandemic reported the prevalence of asymptomatic infection among HCWs to reach 7.1%, although this decreased significantly over the four following weeks to 1.1%¹⁰ leading the authors to suggest a staff testing strategy linked to epidemiological surveillance, where asymptomatic staff screening is offered during new infection waves. Screening of asymptomatic hospital ancillary workers in Singapore revealed a prevalence of <0.1%,¹¹ and the authors suggest that asymptomatic screening programmes should not be necessary in hospitals with adequate PPE provision and training, comprehensive sickness-surveillance systems and universal mask policies.

What this study adds

Our findings indicate that, within the context of local lockdowns due to high community transmission rates, volun-

Table 1 Description of screening participants

<i>TOTAL, n</i>	1150
Age, median (IQR)	46 (34–55)
Sex, n (%)	
Female	972 (84.5%)
Male	175 (15.2%)
Missing	3 (0.3%)
Ethnicity, n (%)	
White	777 (67.5%)
South Asian	234 (20.4%)
Black	58 (5.0%)
Other	51 (4.4%)
Missing	30 (2.6%)
Occupation, n (%)	
Doctors	42 (3.7%)
Nurses/HCAs	564 (49.0%)
Allied health professionals/pharmacy	50 (4.4%)
Admin/executive	259 (22.5%)
Radiographers	42 (3.7%)
Healthcare scientists	29 (2.5%)
Estates	78 (6.8%)
Other	25 (2.2%)
Missing	61 (5.3%)
Speciality, n (%)	
Emergency department/acute medicine	95 (8.3%)
Medicine	218 (19.0%)
Surgery	260 (22.6%)
Paediatrics	48 (4.2%)
Haematology/oncology	60 (5.2%)
Radiology/imaging	126 (11.0%)
Obstetrics & gynaecology/maternity	27 (2.4%)
Anaesthetics/ITU	40 (3.5%)
Laboratory-based (inc histology/microbiology)	23 (2.0%)
Estates/facilities	22 (1.9%)
Admin/executive	51 (4.4%)
Other clinical services (inc pharmacy)	70 (6.1%)
Other	49 (4.3%)
Missing	61 (5.3%)
IMD quintile, n (%)	
1 (most deprived)	183 (15.9%)
2	234 (20.4%)
3	222 (19.3%)
4	261 (22.7%)
5 (least deprived)	250 (21.7%)
Postcode, n (%)	
LE2 area	176 (15.3%)
Outside LE2 area	974 (84.7%)
SARS-CoV-2 NAAT result, n (%)	
Positive	0 (0.0%)
Negative	1150 (100.0%)

tary testing of asymptomatic staff has low uptake (especially among medical staff) and low yield and thus its premise and cost-effectiveness should be re-considered.

Reasons for such a low infection prevalence in our setting may include mandatory use of fluid repellent surgical masks for all staff at all times, social distancing measures and provision of personal protective equipment.

Provision of asymptomatic screening programmes may provide some reassurance to patients and HCWs, but given the likelihood of a low yield, this has to be balanced with the significant resource implications involved. However, should hospitalized cases of COVID-19 rise dramatically then this will need to be re-evaluated.

Our findings are of critical public health and operational relevance. Firstly, to inform responses to spikes in COVID-19 transmission and subsequent local lockdowns in other areas of the UK. Secondly, to sound a note of caution ahead of the newly announced UK government initiative ‘Operation Moonshot’, a £100bn expansion of SARS-CoV-2 testing which includes plans for regular testing of HCWs and others in high risk occupations.¹²

Limitations of this study

Our data are from a single centre. Although our sample size is large, it represents <10% of the entire workforce of UHL. Participation was on a voluntary basis, which may have introduced bias.

Author contributions

DRJ, PP, NJB, KK and MP conceived the idea for the service evaluation. CG and PP collected the data. CAM analysed the data and wrote the first draft of the manuscript. All authors contributed to planning and management, data analysis and revision of the manuscript and were in agreement to submit it for publication.

Acknowledgements

CAM is a National Institute of Health Research (NIHR) Academic Clinical Fellow. KK is supported by the NIHR Applied Research Collaboration East Midlands (ARC EM). KK and MP are supported by NIHR Leicester Biomedical Research Centre (BRC). MP is supported by an NIHR Development and Skills Enhancement Award. The views expressed are those of the authors and not necessarily those of the NIHR, NHS or the Department of Health and Social Care.

Conflict of interest

KK is the Chair of SAGE Sub-group on Ethnicity and COVID and a Member of Independent SAGE. MP reports

grants and personal fees from Gilead Sciences and personal fees from QIAGEN, outside the submitted work.

Funding

MP is in receipt of funding from UK Research and Innovation/Medical Research Council (MR/V027549/1). The funders had no role in design, data collection and analysis, decision to publish or preparation of the manuscript.

References

- 1 UK Government. Coronavirus (COVID-19) in the UK. <https://coronavirus.data.gov.uk/healthcare> (21 August 2020, date last accessed).
- 2 UK Government. Guidance: new national restrictions from 5 November 2020. <https://www.gov.uk/guidance/new-national-restrictions-from-5-november> (4 November 2020, date last accessed).
- 3 Ministry of Housing, Communities and Local Government. English indices of deprivation 2019. <https://www.gov.uk/government/statistics/english-indices-of-deprivation-2019> (21 June 2020, date last accessed).
- 4 University Hospitals of Leicester NHS trust. Equality and inclusion annual report. 2019. <http://www.library.leicestershospitals.nhs.uk/EandD/Shared%20Documents/Equality%20and%20Diversity/Equality%20Annual%20Report%202018-19%20-%20final.pdf> (13 July 2020, date last accessed).
- 5 Nguyen LH, Drew DA, Graham MS *et al.* Risk of COVID-19 among front-line health-care workers and the general community: a prospective cohort study. *Lancet Public Health* 2020;**5**(9):E475–83.
- 6 Martin CA, Patel P, Goss C *et al.* Demographic and occupational determinants of anti-SARS-CoV-2 IgG seropositivity in hospital staff. *The Journal of Public Health*.
- 7 Carter B, Collins JT, Barlow-Pay F *et al.* Nosocomial COVID-19 infection: examining the risk of mortality. The COPE-Nosocomial Study (COVID in Older PEople). *J Hosp Infect* 2020;**106**(2):376–84.
- 8 Tabata S, Imai K, Kawano S *et al.* Clinical characteristics of COVID-19 in 104 people with SARS-CoV-2 infection on the Diamond Princess cruise ship: a retrospective analysis. *Lancet Infect Dis* 2020;**20**(9):1043–50.
- 9 Black JRM, Bailey C, Przewrocka J *et al.* COVID-19: the case for health-care worker screening to prevent hospital transmission. *The Lancet* 2020;**395**(10234):1418–20.
- 10 Treibel TA, Manisty C, Burton M *et al.* COVID-19: PCR screening of asymptomatic health-care workers at London hospital. *The Lancet* 2020;**395**(10237):1608–10.
- 11 Chow A, Htun HL, Kyaw WM *et al.* Asymptomatic health-care worker screening during the COVID-19 pandemic. *The Lancet* 2020;**396**(10260):1393–4.
- 12 Iacobucci G, Coombes R. Covid-19: government plans to spend £100bn on expanding testing to 10 million a day. *BMJ* 2020;**370**:m3520.