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Short Communication

A SARS-CoV-2 outbreak in a public order and safety training facility in England, June 2021

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Abstract

Background The public order and safety (POS) sector remains susceptible to severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) outbreaks, as workplace attendance is typically compulsory and close physical contact is often needed. Here, we report on a SARS-CoV-2 outbreak with an attack rate of 39% (9/23), which occurred between 19 and 29 June 2021 among a cohort of new POS recruits participating in a mandatory 18-week training programme in England.

Methods The COVID-OUT (COVID-19 Outbreak investigation to Understand Transmission) study team undertook a multidisciplinary outbreak investigation, including viral surface sampling, workplace environmental assessment, participant viral and antibody testing, and questionnaires, at the two associated training facilities between 5 July and 24 August 2021.

Results Environmental factors, such as ventilation, were deemed inadequate in some areas of the workplace, with carbon dioxide (CO_2) levels exceeding 1,500 ppm on multiple occasions within naturally ventilated classrooms. Activities during safety training required close contact, with some necessitating physical contact, physical exertion, and shouting. Furthermore, most participants reported having physical contact with colleagues (67%) and more than one close work contact daily (97%).

Conclusions Our investigation suggests that site- and activity-specific factors likely contributed to the transmission risks within the POS trainee cohort. Potential interventions for mitigating SARS-CoV-2 transmission in this POS training context could include implementing regular rapid lateral flow testing, optimizing natural ventilation, using portable air cleaning devices in classrooms, and expanding use of well-fitted FFP2/FFP3 respirators during activities where prolonged close physical contact is required.

Key words: COVID-19; outbreak; public order and safety sector; SARS-CoV-2; workplace.

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What's Important About This Paper?

Public order and safety officers are integral essential workers and experienced increased vulnerability to COVID-19 during the pandemic. This outbreak investigation at a public order and safety facility described workplace-associated and worker-related risk factors, and suggests some successful implementation of infection control measures. Opportunities for improvement were found in the areas of ventilation, personal protective equipment, and the implementation of a regular testing regimine.

Introduction

The coronavirus disease 2019 (COVID-19) pandemic and the associated policy response introduced major shifts in the roles, operations, and safety of workers in the public order and safety (POS) sector (Maskály et al. 2021). Data from the UK Health Security Agency (UKHSA) suggest that first responder (i.e., ambulance, fire service, and police) and military workplaces in England experienced a high incidence of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) outbreaks, with 57 outbreaks detected between 18 May and 12 October 2020 (Chen et al. 2022). During this same period, POS recruitment increased in the United Kingdom (Home Office 2021), with new recruits going through intensive training programmes, including both classroom-based and practical sessions on procedures, personal safety, first-aid, and driving (Home Office 2024). Here, we report on a SARS-CoV-2 outbreak with an attack rate of 39%, which occurred between 19 and 29 June 2021 among a cohort of new POS recruits participating in a mandatory 18-week training programme during the phased reopening from the third national lockdown in the United Kingdom (Institute for Government Analysis 2021). This outbreak investigation was conducted using the standardized protocol of the broader COVID-19 Outbreak investigation to Understand Transmission (COVID-OUT) Study (Chen *et al.*, 2021a), which has systematically collected data from workplace SARS-CoV-2 outbreaks in the United Kingdom with the aim of better understanding occupational risk factors for transmission across different work sectors (Raja et al. 2022; Chen et al. 2023; Graham et al. 2023; Nicholls et al. 2023; Raja *et al.*, 2024).

Methods

Between 5 July and 24 August 2021 (Fig. 1), the COVID-OUT study team undertook a multidisciplinary outbreak investigation, which included viral surface sampling, workplace environmental assessment, participant viral and antibody testing, and questionnaires. Ethical approval for the study was provided by the National Health Service (NHS) North East Research Ethics Committee (Reference 20/NE/0282).

The POS workplace comprised two facilities: a Learning and Development (L&D) building (Supplementary Fig. S1a) and an associated POS workplace (sports hall and changing facilities only) (Supplementary Fig. S1b). On 8 and 9 July 2021, COVID-OUT microbiologists collected 53 surface samples from the classrooms, toilets, changing rooms and canteen in the L&D building and 37 surface samples from the sports hall in the associated POS workplace. As described previously (Raja et al. 2022; Chen et al. 2023; Graham et al. 2023; Nicholls et al. 2023; Raja *et al.*, 2024), surface samples were analysed using the CerTest Biotec Viasure (Zaragoza, Spain) two-target nucleocapsid (N) and open reading frame 1 a and b (ORF1ab) assay. On 3 and 4 August 2021, COVID-OUT industrial hygienists undertook a detailed environmental assessment (for full data collection framework, see Chen *et al.*, 2021b). Between 3 and 22 August 2021, carbon dioxide (CO_2) levels were collected longitudinally using Honeywell BW Solo monitors. CO_2 levels exceeding 1,500 ppm were considered indicative of inadequate ventilation (Chartered Institution of Building Services Engineers 2021).

The 165 POS employees, including the trainee cohort, who used the two facilities between 15 June and 2 July 2021 were invited to take part in the current study by undergoing SARS-CoV-2 testing and providing information (for questionnaires, see Chen *et al.*, 2021c) related to working patterns, COVID-19-related medical history, and potential risk factors (e.g., close contacts, use of face coverings). Participants self-administered nose and throat swabs at study weeks 0, 2, and 3 for quantitative reverse transcription-polymerase chain reaction (qRT-PCR) testing using the Roche cobas® (Basel, Switzerland) SARS-CoV-2 assay. Phlebotomists collected blood from participants at baseline and either on study week 5 or 9, depending on participant availability, to test for antibodies using the Roche Elecsys® Anti-SARS-CoV-2 spike (S) and N binding assays. Confirmed and suspected cases included individuals with evidence of SARS-CoV-2 infection during the outbreak period (19 to 29 June 2021) (for full case definitions, see Supplementary Table S1).

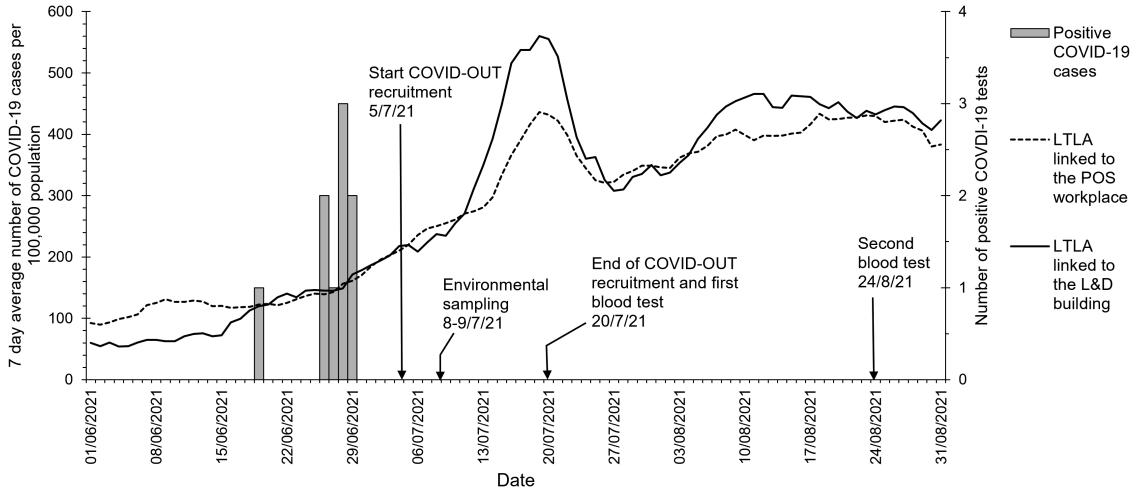

Fig. 1. Timeline of COVID-19 outbreak investigation in a training facility (L&D building) and associated public order and safety workplace (POS workplace) between 5 July and 24 August 2021. Arrows indicate keys dates of the outbreak and COVID-OUT study. The line chart represents the 7-day case rate for the Lower Tier Local Authority (LTLA) area of the site (publicly available data from UK Health Security Agency., 2022; date of download 2 December 2021). The bars show an epidemiological curve of COVID-19 cases confirmed by positive lateral flow test reported to the site by the training cohort.

Results

Following classroom-based training on 17 June 2021 and safety training in the L&D building sports hall on 18 June 2021, the first SARS-CoV-2 case was qRT-PCR-confirmed on 19 June 2021 (symptoms reported on 18 June), triggering a three-day break in training. Eight subsequent trainee infections were reported between 26 and 29 June following four days of classroom-based training in the L&D building and three days of safety training in the POS workplace sports hall (Supplementary Fig. S1). No cases were reported by the employer outside of the training cohort during or after the outbreak period. All 90 surface samples collected during this investigation tested negative for SARS-CoV-2 RNA.

In the environmental assessment, COVID-OUT industrial hygienists found that the POS facility mandated face covering use and provided disposable IIR surgical masks. Hand sanitizer stations were positioned near building and room entrances, as well as within classrooms and sports halls. Cleaning wipes were also available to clean desks, office equipment, and canteen tables, and disinfectant sprays were available for cleaning sports equipment. Shared areas were cleaned once per day, and changing rooms and main toilets were cleaned twice per day. Anti-viral fogging was undertaken when positive SARS-CoV-2 cases were identified.

In the L&D building, ventilation in both the IT classrooms (recycling air conditioning [A/C] units fitted) and the general classrooms (no A/C units fitted) relied on natural ventilation via the opening of windows by room occupants. To encourage physical distancing, room occupancy restrictions were enforced, and the trainee cohort was divided into two groups when using the IT rooms and general classrooms. In IT room A and Classroom C, CO_2 levels were found to transiently peak above 1,500 ppm during the investigation period (Supplementary Fig. S2a and b), suggesting potentially inadequate ventilation within these rooms. Noise levels were minimal throughout the facility during the environmental assessment.

During safety training (e.g., resuscitation and restraint training requiring trainees to be in close proximity with some physical contact, exertion, and shouting), trainees were required to use surgical face masks and gloves. During advanced driver training, which required four people to be in close contact in a car, car windows were opened, and disposable FFP3 respirators were used by instructors and trainees. While contracted driving instructors were required to perform two lateral flow tests per week, POS trainees were not tested regularly.

Of the 33 POS workers (61% female, mean age: 34 years [range: 19 to 59], 97% permanent contract employees) who consented to participate in the COVID-OUT Study, 30 (91%) did not become cases (Table 1); of note, the standardized questionnaire did not allow us to determine whether the three cases included members of the trainee cohort. Notably, 100% (33/33) of participants had detectable SARS-CoV-2 S or N antibodies, including 27% (8/30) of non-cases who had detectable SARS-CoV-2 N antibodies, providing evidence of infections prior to this outbreak (Supplementary

Table 1. Laboratory and questionnaire data from study participants who attended the training facilities between 15 June and 2 July 2021 (n = 33).

Variable	Categories	Non-cases (n = 30)	Confirmed cases (n = 3)	All participants (n = 33)
Signs and symptoms during outbreak period (19 to 29 June 2021)	None reported/missing	2 (6.7)	0	2 (6.1)
	Fever	7 (23.3)	2 (66.7)	9 (27.3)
	Productive cough	2 (6.7)	1 (33.3)	3 (9.1)
	Dry cough	4 (13.3)	2 (66.7)	6 (18.2)
	Shortness of breath	5 (16.7)	0	5 (15.2)
	Loss of taste and smell	3 (10.0)	1 (33.3)	4 (12.1)
Vaccination prior to 15 June 2021	1st dose	19 (90.5)	2 (100)	21 (87.5)
	2nd dose	11 (52.4)	1 (50)	12 (50.0)
	Unreported	9	1	10
Physical contact at work	No	9 (30.0)	2 (66.7)	11 (33.3)
	Yes	21 (70.0)	1 (33.3)	22 (66.7)
Lean-in to be heard at work	No	15 (50.0)	1 (33.3)	16 (48.5)
	Yes	15 (50.0)	2 (66.7)	17 (51.5)
Number of close contact work per day	0	1 (3.4)	0	1 (3.1)
	1 to 5	5 (17.2)	0	5 (15.6)
	6 to 20	7 (24.1)	1 (33.3)	8 (25.0)
	Over 21	16 (55.2)	2 (66.7)	18 (56.3)
	Missing	1	0	1
Wear washable mask/face covering	Never	11 (37.9)	0	11 (34.4)
	Less than half the time	1 (3.4)	1 (33.3)	2 (6.3)
	More than half the time	4 (13.8)	0	4(12.5)
	Nearly all the time	13 (44.8)	2 (66.7)	15 (46.9)
	Missing	1	0	1
Wear surgical mask/disposable mask	Never	1 (3.4)	1 (25)	2 (6.3)
	Less than half the time	3 (10.3)	0	3 (9.4)
	More than half the time	6(20.7)	0	6 (18.8)
	Nearly all the time	19 (65.5)	2 (66.7)	21 (65.6)
	Missing	1	0	1
Wear FFP2 or FFP3 respirator	Never	25 (83.3)	2 (66.7)	27 (81.8)
	Less than half the time	2 (6.7)	0	2 (6.1)
	More than half the time	3 (10.0)	1 (33.3)	4 (12.1)
	Nearly all the time	0	0	0

COVID-19 = coronavirus disease 2019, Ig = immunoglobulin, RT-PCR = reverse transcription-polymerase chain reaction, FFP = filtering facepiece, BMI = Body Mass Index.
[a]Individuals lost to follow up (2 individuals for 1st PCR, 21 individuals for 2nd PCR, 17 individuals for 3rd PCR).
Invalid PCR tests counted as missing.
Vaccine dose categories are not mutually exclusive. Variables containing information of ages of household members are also not mutually exclusive.
Close contact defined as having contact for more than 15 min at a distance of less than 2 m.
The face covering variables were not mutually exclusive. Of note, n = 1 non-case reported never wearing a face covering, mask, or respirator, and n = 1 case reported wearing washable face covering/mask but never wearing a surgical mask or respirator.

Table S2). From the questionnaire responses, 70% (23/33) of participants reported having received at least one dose of a COVID-19 vaccine (Table 1 and Supplementary Table S2). Overall, self-reported workplace face covering use was high, with most reporting use of surgical face masks (30/32, 94%) and of FFP2/FFP3 respirators (6/33, 18%) at least some of the time. Most participants (23/32, 72%) reported increasing their hand washing frequency compared to pre-pandemic levels, and 100% (33/33) of participants

reported having access to hand sanitizing facilities (Supplementary Table S2). The majority reported having received COVID-19 preventive training (29/33, 88%). Most participants reported having close physical contact with colleagues (22/33, 67%) or having to lean in to be heard by colleagues (17/33, 52%). Almost all respondents reported having multiple close contacts (i.e., contact for more than 15 min at a distance <2 m) at work (31/32, 97%), with most (17/32, 53%) reporting 21 to 100 close work contacts per day; 75% of participants (24/32) also reported having >3 close social contacts per day.

All staff were required to self-isolate following a positive COVID-19 test, and the sick pay policy for all staff, including trainees, provided up to 6 months of full pay. Most participants did not think their income would reduce (21/32, 66%) or had any concerns around unemployment (26/32, 81%) if they were required to self-isolate.

Discussion

A SARS-CoV-2 outbreak occurred at a POS workplace in England during a period of low but steadily increasing community transmission (UK Health Security Agency 2022). The outbreak was isolated to a cohort of new recruits undertaking mandatory training, and the lack of reported cases among workers outside this cohort suggests the previously implemented preventive measures (e.g., compulsory face mask wearing, hand/surface sanitizing, and paid sick leave to discourage presenteeism) were effective at controlling the wider spread of the outbreak. Additionally, serological evidence from study participants indicates that all had pre-existing immunity from prior infections and/ or vaccination, which, if extrapolated to the broader POS workforce, likely limited onward transmission in the workplace.

While natural ventilation, such as was used in the L&D building classrooms, can be effective at lowering transmission risk in indoor settings (Villers et al. 2021), its effectiveness is dependent on environmental factors (e.g., humidity, indoor–outdoor temperature difference, and wind speed) and compliance with guidance to open windows (Bhagat et al. 2020). CO_2 monitors could be used to inform room-specific risk assessments and to raise awareness of the need to enhance ventilation and/or lower occupancy. Where adequate ventilation cannot be achieved, in conjunction with other preventive measures (e.g., face mask/respirator wearing, regular testing, and isolating of infected workers), air cleaning (e.g., via the use of portable HEPA units) could be used to help reduce transmission risks in classrooms (Morris et al. 2022), but would be expected to be less effective in the larger volume halls.

Safety training remains essential preparation for performing live POS duties in public. However, close contact activities, especially those requiring physical exertion and shouting, likely increased transmission risks during this outbreak. Although surgical masks can reduce outward particle transmission (Asadi et al. 2020) and filter out virus particles upon inhalation, FFP2/FFP3 respirators may offer a more effective alternative for mitigating SARS-CoV-2 transmission during close contact training activities. Nevertheless, effective implementation of FFP2/FFP3 respirators would require face-fit testing and user training. Moreover, all types of face coverings may become dislodged and less effective during highly physical activities. The introduction of SARS-CoV-2 lateral flow testing of trainees may also yield important benefits by preventing sources of infection from being introduced into the workplace (Telford 2020); however, regular testing would also incur additional time and financial costs.

This investigation had several limitations. We were unable to discern whether the low infection rate amongst participants was due to the preventive measures implemented or due to pre-existing immunity from prior viral exposure. The delay between the notification of the outbreak and surface sampling (approximately 14 to 17 days after cohort use) may explain the lack of viral recovery. The absence of positive surface samples made it difficult to ascertain whether viral shedding from cases was likely to be widespread or concentrated in specific areas of the site. Additionally, although CO_2 was used as a proxy for ventilation rate and identified areas of poor ventilation at this site, it is not a direct proxy for infection risk (Chartered Institution of Building Services Engineers 2021). The low questionnaire response rate and small number of confirmed cases precluded investigation of the risks attributable to different occupational behaviours (e.g., types and frequency of face covering use) and individual characteristics (e.g., vaccine history). Finally, as the questionnaire was designed *a priori* to be applicable to different outbreak settings and to minimize disclosure risks for specific participant subgroups, relative risks between trainees and qualified employees could not be investigated. Future investigations of training in the POS sector could be strengthened by recruiting larger numbers of participants from multiple trainee cohorts across different regions and evaluating their contact dynamics with qualified employees in the same workplaces.

Conclusion

Our investigation suggests that both site- and activity-specific factors likely contributed to the transmission risks within the POS trainee cohort and should

be considered in future risk assessments. Standard training in the POS sector requires uniquely close contact activities (e.g., resuscitation and restraint training) that introduce distinct challenges for preventing SARS-CoV-2 transmission as compared to other work sectors (e.g., storage and distribution [Raja et al., 2024], manufacturing [Raja et al. 2022; Graham et al. 2023] or public-facing offices [Nicholls et al. 2023]). Despite having some unique occupational risks of exposure, potential interventions for mitigating SARS-CoV-2 transmission in POS training are similar to those in other sectors and could include implementing regular rapid lateral flow testing, optimizing natural ventilation, using portable air cleaning devices in classrooms, and expanding use of well-fitted FFP2/FFP3 respirators in activities where prolonged close physical contact is required.

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Conflict of interest

The authors have no conflict of interests to declare.

Patient consent statement

The COVID-OUT study has been approved by the NHS North East Research Ethics Committee (Reference 20/NE/0282). Informed consent was obtained from all study participants.

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Disclaimer

The contents of this paper, including any opinions and/or conclusions expressed, are those of the authors alone and do not necessarily reflect Health and Safety Executive or UK Health Security Agency policy.

Data availability

The data that support the findings of this study are available on reasonable request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

Supplementary material

Supplementary material is available at *Annals of Work Exposures and Health* online.

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