



# COVID-19 within a large UK prison with a high number of vulnerable adults, march to june 2020: An outbreak investigation and screening event

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## ABSTRACT

**Objective:** To describe the public health response to COVID-19 within a large prison with a high number of clinically vulnerable residents.

**Design:** An outbreak investigation was undertaken among all residents and staff. A screening event involved nose and throat swab samples from residents and staff, examined by polymerase chain reaction (PCR). An electronic questionnaire regarding risk factors was distributed to staff.

**Results:** 58 residents out of 1,156 (5.0%, 95% CI: 3.8 – 6.3) and 129 staff out of 510 (25.3%, 95% CI: 21.5 – 29.1) displayed COVID-19 symptoms, including six and eight confirmed, respectively. Residents reported cough symptoms with no fever (29.3%), followed by a cough and fever (15.5%). 62.1% of symptomatic residents were 50 years or older, placing them in the group at risk for severe COVID-19 disease. Wing I had the highest attack rate (12.5%). 1,063 individuals were swabbed during the 5-day screening event, and all had negative swab results.

**Conclusion:** The findings were consistent with the hypothesis of a propagating outbreak with decreasing incidence since the peak date of onset. COVID-19 transmission within a high-risk setting was quickly contained, and an explosive outbreak was prevented through a multi-agency public health response.

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## Introduction

Coronavirus disease (COVID-19) is an infectious disease caused by the most recently discovered severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). The virus was unknown before the outbreak began in China in December 2019 and has since spread worldwide (Zhu et al., 2020). The impact of the epidemic has been noted in many community sectors, including institutional settings, such as prisons. Many prison residents are at higher risk of severe

COVID-19 and death due to significant co-morbidities, and advanced age in some prisons (Amon, 2020; Kinner et al., 2020). The older prison population has significantly increased over the last 20 years, and while the proportion of prison residents over the age of 60 is slightly less than the general population, research shows that prisoners have an accelerated aging process, and their health-related needs are advanced by around ten years (Parliament, 2020; ONS, 2020a). Due to the overcrowded nature of prisons where social-distancing is less achievable, COVID-19 will likely spread faster and cause explosive outbreaks if not quickly controlled (Amon, 2020; Barnert et al., 2020; Kinner et al., 2020). This report details an effective multi-agency public health response to a COVID-19 outbreak within a large prison setting with a high number of medically vulnerable residents.

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## Methods

### *Outbreak detection and public health response*

The prison, an all-male category C prison, has approximately 1,156 inmates at any given time and 510 staff. At the time of the outbreak, the median age of residents was 48 years, with a range from 21 to 89. Staff members include prison officers, management staff, and agency staff working in various parts of the prison. The prison has thirteen wings, labeled from A to M; population sizes range in each wing from 15 to over 120 residents. A total of 488 residents are at higher risk for more severe COVID-19 due to comorbidities and/or older age; 180 of them are classed as extremely vulnerable, based on the UK's National Health Services (NHS) classification of risk from coronavirus (NHS, 2020).

On 24 March, 2020, a Public Health England (PHE) Health Protection Team (HPT) received notification from a health care provider at the prison informing them that a hospitalized resident who died on 22 March, tested positive for COVID-19. This resident was terminally ill and became unwell on 11 March with fever and shortness of breath, deteriorated on 18 March, and was admitted to hospital the next day. Several healthcare workers and staff within the prison had been in contact with the resident between 11 and 19 March.

An incident management team (IMT) meeting took place on 25 March with representatives from the Local Authority, Public Health England HPT and National Health and Justice team, prison management and healthcare, Her Majesty's Prison and Probation Service (HMPPS), and NHS England. A COVID-19 outbreak was declared shortly after the first IMT was held due to the presence of four other symptomatic residents linked to the first person, time, and place (within the same wing), 20 symptomatic staff throughout the prison, and the risk of further spread and severe disease for many of the residents.

### *Outbreak response*

The outbreak investigation took place between March and June 2020 and included all staff and residents. Following a PHE Health and Justice team's consultation, a new national restricted movement regime was implemented by HMPPS on 24 March (O'Moore, 2020). This included restricting symptomatic and COVID-19 positive residents in their own cell for seven days (in accordance with relevant authorities at the time) with meals and medications served in their cells, and all social visits and extra-curricular activities were stopped across the entire prison. Social distancing of two meters for staff and inmates where possible was strictly enforced and a new cohorting strategy was also implemented, which involved staff cohorting groups when they came out of their cells. Transfers between prisons were also stopped through an order issued by HMPPS on 31 March to prevent seeding new infections and subsequent outbreaks in prisons receiving infected prisoners (O'Moore, 2020).

Staff overseeing a cohorted population limited movements to other parts of the prison to avoid widespread infection transmission. In cases where two or more people shared a cell/room and one developed symptoms, all cell sharer contacts were isolated for 14 days. If a transfer was unavoidable, new receptions were assessed for signs and symptoms of COVID-19, and any symptomatic new arrivals were isolated/cohorted immediately. All other new receptions were isolated in a Reverse Cohorting Unit (RCU) for 14 days and closely monitored by the healthcare team.

The 488 vulnerable residents were put into protective isolation from 25 March, i.e., they stayed within their own cell at all times with meals and medications served at their doors. They were attended to by healthcare staff in full personal protective

equipment (PPE) if they needed to be seen. Prison staff were advised to maintain a distance of two meters from the resident at all times and use PPE when they needed to attend a resident within two meters.

A communications strategy was agreed upon at the first IMT meeting and reviewed throughout the investigation. The Prison developed a local protocol to keep all residents and staff fully informed about the situation daily using different channels. Residents were given leaflets through doors, regular briefings through in-cell television, and healthcare and wing prison staff were available to clarify queries. All prison staff on duty had daily morning briefings, which included COVID-19 as the main subject. These reminded everyone of critical public health messages, i.e., social distancing, hand hygiene, respiratory hygiene, COVID-19 symptoms, what to do, and what not to do. An HMPPS national team was identified as the communications lead for outside agencies, and communications teams of each partner organization were in contact with each other to ensure that messages were consistent and updated relevant people within their own organizations. The use of communication through the media was considered a valuable part of the control strategy, and the IMT agreed to reactive media engagement as necessary. Communications were also shared between the prison management and staff every week regarding the outbreak and ongoing prevention measures through emails and bulletins.

At the beginning of the outbreak, access to testing for residents was limited. Following the declaration of the outbreak, additional swabbing for symptomatic residents was requested. The local NHS Clinical Commissioning Group liaised with the prison management and healthcare team to arrange the swabbing. A full respiratory viral panel was requested for all initial samples. Laboratory results for ten symptomatic residents identified COVID-19 in three individuals and human metapneumovirus in two individuals. When a few positive laboratory samples had been received from residents who had been swabbed, subsequent cases who met the clinical case definition were included as "possible/probable cases." At the beginning of May, testing became more widely available, and from then on every resident who developed symptoms was quickly tested by prison healthcare staff to determine if COVID-19 was still circulating within the prison.

The outbreak among residents was coming under control within the first two weeks of notification. As community transmission was ongoing, the prison staff continued to develop symptoms over the following months. IMT members were concerned this would lead to the re-introduction of COVID-19 within the prison. Hence, IMT members agreed on 06 May that a one-time universal screening via a PCR test of all staff and residents should be undertaken to identify and isolate them, if positive before they developed symptoms to reduce the risk of further transmission within the prison.

### *Universal Screening Methodology*

The screening event consisted of a PCR test and aimed to test all residents and staff within the prison at the end of the outbreak, over five days at the beginning of June 2020. The Department of Health and Social Care (DHSC) and HMPPS National team provided operational assistance and facilitated this increased testing event. A clear communication strategy was put in place in advance of the testing by prison management. Information and consent forms were provided to all staff and residents before swabbing. Participation was voluntary, and neither staff nor residents faced any punitive action if they decided not to participate. Residents who had previously tested positive for COVID-19 were excluded from the screening event. Staff who had previously tested positive for COVID-19 were also told they did not need to participate. Staff

were asked to book an appointment online to ensure social distancing was maintained during the screening event and limit the possible impact on the regime for residents.

The PHE Field Service developed an electronic questionnaire for staff using the survey creation tool Snap Survey. A link to this survey was distributed ahead of the screening event. Questions comprised of demographics, role within the prison, general health, mechanism of travel to work, previous COVID-19 symptoms and test results, and symptomatic household family members.

The screening involved a polymerase chain reaction (PCR)-based nose and throat swab test to detect SARS-CoV-2 infection in upper respiratory tract samples from asymptomatic staff (under the assumption that those with symptoms meeting the case definition will not be working, as per national guidelines) and residents. Staff were swabbed by the prisons' occupational health services, and residents self-swabbed in their cells under supervision to ensure it was performed correctly. The swabs were then bulk-sent to a pillar 2 (commercial) laboratory for testing. Staff received notification of their test result directly and were responsible for notifying their single point of contact if their test was positive. Resident results were sent to the prison healthcare team, so they could respond accordingly.

**Data analysis**

During the study period (March to June 2020), symptomatic residents were followed up daily by the prison healthcare staff. Data on symptomatic residents was collected from the NHS health database, mandatory reporting of lab results, and PHE HPZone database. Data on symptomatic staff was collected from the prison management source.

Descriptive epidemiology was conducted on the data collected during the outbreak. Outcomes of interest included COVID-19-like symptoms and/or a positive PCR laboratory test, hospital admission due to COVID-19, or a COVID-19 related death. Nationally agreed case definitions for COVID-19 were used (Public Health England, 2020). A death was considered related to COVID-19 when it was declared as such by a medical professional. Data from the prison were shared via a secure, encrypted method and entered into an excel file stored on a secure server.

Data from the completed questionnaires were automatically uploaded into a secure Snap Survey database and then exported into a Microsoft Excel spreadsheet. Only staff with a completed

questionnaire were included in the final analysis. All results were analyzed in STATA 15.

**Results**

*Outbreak investigation*

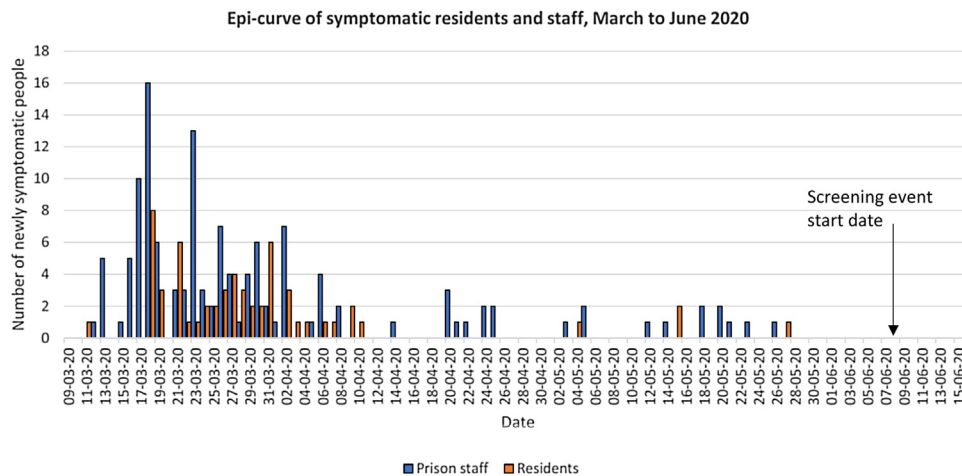
The index case (resident) displayed symptoms on 11 March (Figure 1). Over the following week, twelve staff members reported COVID-like symptoms. The epidemiological curve for residents and staff in Figure 1 shows evidence of a propagating outbreak with a peak on 18 March and then decreasing incidence.

In total, 58 residents (5.0% of the total prison population, 95% CI: 3.8 – 6.3) with COVID-19 related symptoms were reported across the whole prison, including six confirmed (out of 16 tested). Five residents had been hospitalized due to COVID-19, and three died. A total of 129 staff (25.3% of total staff population, 95% CI: 21.5 – 29.1) reported COVID-19-related symptoms, and eight were confirmed positive (out of thirteen tested).

All residents were male, and the median age was 57.5 years, ranging from 22 to 84. 29.3% of symptomatic residents reported cough symptoms with no fever, followed by 15.5% with a cough and fever, consistent with the national case definition for COVID-19. None of the residents reported the loss of smell or taste.

62.1% of residents who displayed symptoms were 50 years or older, placing them in the group at risk for severe COVID-19 disease. Out of the 488 vulnerable residents, only 6.6% displayed COVID-like symptoms during the outbreak; seven from the extremely vulnerable group and 25 from the other clinically vulnerable group.

Attack rates for residents varied by wing; wing I had the highest attack rate of 12.5%, and wing F had no symptomatic residents. When looking at the proportion of symptomatic residents out of the total number of symptomatic residents, 25.9% of all symptomatic residents were from wing I, followed by wing L with 12.1% and wing K with 10.3%. The overall attack rate for wings with less than 100 residents was slightly lower than those with over 100 residents: 2.6% versus 5.3%, respectively. For staff who had direct contact with residents, their work location was analyzed to determine which area had the highest proportion of symptomatic staff. Similar to residents, wings I and L had high proportions of symptomatic staff, 5.4% and 6.9%, respectively. However, health-care staff and physical education instructor/Gym staff (who were



**Figure 1.** Epidemiological curve of residents and staff within the prison who displayed COVID-19 compatible symptoms, March to June 2020.

involved in bringing medications to residents) also had high proportions of symptomatic staff, with 5.4% and 6.2%, respectively.

### Universal Screening Results

The screening took place over five days in June, and, in total, 1,063 individuals were screened: 806 residents (69.7% participation rate) and 257 staff (65% participation rate of eligible staff). Uptake among residents varied by wing with low uptake (less than 50% participation) noted for wings F, G, and N: 42%, 27%, and 35% of residents in those wings were swabbed, respectively. Wings I, E and J had the highest uptake, with 100%, 84%, and 84% of residents in those wings swabbed, respectively. All 1,063 individuals had negative swab results (0.0% positivity; 95% CI: 0.0 to 0.004).

258 questionnaires were attempted by staff, with a 75.2% completion rate. 2.6% (5 of 190) of staff reported they had been in contact with a household member who was a suspected case in the past month; however, 8.4% (16 of 191) of staff reported that one or more of their household family members had experienced symptoms in the past month. 8.9% (17 of 190) reported they had been in contact with a co-worker who was a suspected case. 8.2% (16 of 194) of staff reported a previous COVID-19 test: of those 16, 75.0% (twelve) were negative, 18.8% (three) were positive, and one result was unknown.

46.8% (89 of 190) of staff members reported experiencing any symptom (atypical or typical) in the past month, and 25.8% (23 of 89) reported that their symptoms had lasted more than 14 days. Two staff members reported both a loss of smell and taste over the past month, and both previously had a positive COVID-19 test.

Among the resident population who participated in the screening event, the median age was 51 years, slightly younger than the outbreak cohort but older than the overall prison population, ranging from 21 to 89. A high uptake of swabbing among residents was seen in wings with the highest COVID-19 attack rates during the outbreak (Table 1), based on the population in each wing at the beginning of the outbreak (March through 17 June, 2020).

Table 1 Breakdown of attack rate and residents swabbed by wing, using the population of each wing at the beginning of the outbreak, March to June 2020

### Discussion

The findings from the epidemiological investigations were consistent with the IMT hypothesis that this was a propagating outbreak, with decreasing incidence since the peak date on 18 March 2020. The first cases occurred before lockdown and control

**Table 1**  
Breakdown of symptomatic residents and residents swabbed by wing, using the population of each wing at the beginning of the outbreak, March to June 2020

Wing	Population	% outbreak attack rate per wing (95% CI)	% of residents swabbed (95% CI)
A	125	4.0 (0.6 – 7.4)	56.0 (47.3 – 64.7)
B	128	3.9 (0.5 – 7.3)	61.7 (53.3 – 70.1)
C	128	3.9 (0.5 – 7.3)	67.2 (59.1 – 75.3)
D	127	3.2 (0.1 – 6.1)	55.1 (46.5 – 63.8)
E	99	2.0 (-0.8 – 4.8)	53.5 (43.7 – 63.4)
F	36	0.0	41.7 (25.6 – 57.8)
G	40	2.5 (-2.3 – 7.3)	27.5 (13.7 – 41.3)
H	43	4.7 (-1.6 – 11.0)	74.4 (61.4 – 87.5)
I	120	12.5 (6.6 – 18.4)	99.2 (97.5 – 100)
J	120	4.2 (0.6 – 7.8)	83.3 (76.7 – 90.0)
K	120	5.0 (1.1 – 8.9)	60.8 (52.1 – 69.6)
L	120	5.8 (1.6 – 10.0)	61.7 (53.0 – 70.4)
M	14	7.1 (-6.4 – 20.6)	71.4 (47.8 – 95.1)

measures were implemented; therefore, a peak occurring at the beginning of the outbreak is expected. Control measures were quickly implemented after the first case was reported, leading to a steady decrease in cases and prevention of wider spread within the prison.

The COVID-19 screening event at the prison was very successful, with over 1,000 swab samples taken. Screening uptake was high, with 69% of residents and over 65% of staff, including prison officers and healthcare staff, screened. All 1,063 individuals had negative swab results (0.0% positivity; 95% CI: 0 to 0.004). This is lower than the estimated community population rate in England for COVID-19 between 31 May to 13 June 2020 (0.06% of the population of England; 95% CI: 0.02% to 0.13%) (ONS, 2020b). However, these estimations were taken from the ONS national household survey, and it is acknowledged that in other settings (such as institutional settings), the rates were likely to be different (ONS, 2020a). In the prison, residents had been under lockdown with restricted movement since the end of March, making them less likely to encounter others who were potentially infectious (O'Moore, 2020).

### Weaknesses of the study

At the beginning of the outbreak, access to testing for prisoners had been limited. When a number of positive laboratory samples had been received on prisoners who had been swabbed, subsequent cases who met the clinical case definition were included as "possible/probable cases." At the beginning of May, testing became more widely available, and from then on, every resident who developed symptoms was quickly tested. Testing for other respiratory viruses was not common during this time due to decreased lab capacity. In total, there were six confirmed cases of COVID-19 and 52 suspected cases among residents. It is unknown if the suspected cases were true cases of COVID-19 or due to another microorganism; three confirmed cases of human metapneumovirus were also reported among residents at the beginning of the COVID-19 outbreak. This virus is a cause of acute respiratory infection and causes symptoms similar to COVID-19 (e.g., cough, fever, and pneumonia) (Shafaqati and Williams, 2018).

There are some limitations of the screening event. While there was relatively high uptake, approximately one-third of the prison population (residents and staff) did not participate in the screening event. It was noted that the uptake rate was slightly higher for the wings that had over 100 residents (79.5% compared to 55.6% in wings with less than 100 residents). Additionally, wings with a higher attack rate during the outbreak appeared to have higher participation rates, possibly due to self-selection bias (e.g., the residents in those wings considered themselves to be more at risk and so were more motivated to get tested). The questionnaire results may be subject to recall bias as staff were asked to recall any symptoms they and their family members experienced over the past month. Additionally, the results may be subject to selection bias, as only those residents and staff who chose to take part in the screening event and completed the questionnaire (for staff) were included, and therefore may not represent the entire prison population. There was a time delay between the last reported symptomatic resident and staff and the onset of the screening event. The most recent date of symptom onset for residents and staff was 27 May and 26 May, respectively, nearly two weeks before the start of the screening event.

### Implications of the study

COVID-19 cases have been reported in detention settings worldwide, with high rates of infection (Burki, 2020). At the

beginning of the pandemic, the prison system in England was at 97% of its operational capacity, increasing the risk of large outbreaks of COVID-19 (O'Moore, 2020). In England, as of 10 July, 530 cases of COVID-19 had been confirmed among HMPPS service users, with 44 deaths; however, testing was not widely available at the start of the pandemic, so the total burden is underrepresented within England and the rest of the world (Amon, 2020; Ministry of Justice, 2020). Institutional settings are of concern for COVID-19 because of crowding and high proportions of residents with significant health co-morbidities (Amon, 2020; Barnert et al., 2020; Kinner et al., 2020). Maintaining social distancing in these settings can be difficult to implement, as sharing cells is common and shower rooms and dining halls are often communal (Amon, 2020).

The World Health Organization produced guidelines on responding to COVID-19 in prisons, which recommend a coordinated approach and joint working to control the spread of infection (Simpson, Butler, 2020; World Health Organization Europe, 2020), a point that is reinforced by this outbreak and screening event. The outbreak was declared over on 17 June 2020 as there had been no reported cases among residents or staff for over 14 days, per national guidelines at the time, and there was 100% negativity from the screening event. With help from PHE, NHS England, HMPPS, and the Local Authority public health team, the prison management and healthcare team responded quickly to prevent a widespread outbreak of COVID-19 within the prison.

### Contributors

All contributed to the outbreak response and screening event management and study design. JW, AT, and EB conducted the epidemiological analyses. JW drafted the manuscript. All authors contributed to interpreting the analysis, developing the manuscript, and approving the final draft.

### Conflict of interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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### Ethical Approval

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