Detecting and evaluating COVID-19 outbreaks and positivity rates in prisons across England

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SUMMARY

- We evaluate **COVID-19 outbreaks and positivity rates between prison settings and the wider community** to understand the impact of COVID-19 in prisons, which we know are more susceptible to higher disease transmission and infection.
- **Outbreak sizes and lengths are higher in prisons** than in the community, reflecting the impact of larger populations in prisons and the closed environment. However, **positivity in prisons is lower** than in the community throughout the study period, reflecting comprehensive testing policies within prison settings.
- **Improvements in testing and case data flows from vulnerable settings** such as prisons to wider public health systems will improve surveillance of disease burden and expedite effective outbreak management in closed environments.

INTRODUCTION

- The risk of COVID-19 transmission and infection is higher in prison settings due to pre-existing vulnerability among prisoners, the closed environment, and size of setting[1,2].
- National COVID-19 surveillance data collected by the UK Health Security Agency (UKHSA) can be linked to address information to identify tests conducted in prison settings, which allows for monitoring of infections and transmission in prisons.
- Widespread community testing was available from January 2021 to April 2022[3], allowing us to compare the impact of COVID-19 in incarcerated individuals to the general population, which is key to understanding potential inequalities.

METHODS

- Positive and negative SARS-CoV-2 tests were extracted from the Second Generation Surveillance System (SGSS) and the Unified Sample Dataset (USD) for all tests in England between 11 January 2021 to 31 March 2022 when there was free community-wide access to testing.
- **Prison case identification:** Address matching was used to identify unique property reference number (UPRN) and property type among positive COVID-19 episodes in SGSS.
  - Addresses that were linked to a prison, detention centre, or secure unit property type was included as a positive COVID-19 episode in a prison setting.
  - Episodes with a residential dwelling property type were considered a COVID-19 episode occurring in the wider community.
  - To identify positive and negative SARS-CoV-2 prison tests, postcode information from previously address-matched positive episodes were linked to the USD.
  - Tests that were from Lighthouse Labs, tested through Pillar 2, and were not from care home or prison settings were included as tests occurring in the community.
- **Outbreak detection:** Outbreaks were defined as two or more positive cases residing in same UPRN occurring within a 14-day period of the previous case.
  - Wilcoxon Rank Sum testing was used to identify differences in outbreak size (number of cases per outbreak) and length of outbreak (in days) between prison and community settings.
- **Positivity calculations:** Positivity was defined as the proportion of positive tests to all tests sampled over a seven-day rolling period, in prisons and community settings.
  - Binomial 95% confidence intervals were calculated using the Wilson method. Differences in positivity among the two settings were calculated using two-proportion Z-tests.

RESULTS

Overview of population

- From 11 January 2021 to 31 March 2022, 26,600 COVID-19 episodes occurred in prisons, detention centres, or secure units (0.18% of all episodes). 14,126,323 COVID-19 episodes occurred within the wider community (93.9% of all episodes).
- A larger proportion of prison episodes occurred in the 20-39 age group (61.5% of all prison episodes) compared to community episodes (34.9%). 92.0% of prison episodes were male, compared to 45.8% of community episodes.

Outbreak analysis

- 592 outbreaks were identified in prisons in the study period, with median size of 8 cases (IQR: 43 cases) and median length of 16.5 days (IQR: 38 days).
- Outbreaks in the community were smaller and shorter, with median size of 2 cases (IQR: 1 case) and median length of 3 days (IQR: 5 days). These differences were statistically significant (Figure 1).
- These differences were consistent throughout the pandemic, though both outbreak size and length fluctuated much more in prisons than in community settings.

Positivity analysis

- Positivity in prisons ranged from 2.5% to 24.4% in the study period, with median positivity at 5.2%. Median positivity was higher in the community at 19.0%, with positivity ranging from 5.6% to 51%. These differences were statistically significant.
- Barring the period between mid January 2021 to March 2021 where positivity in the two settings were similar, positivity in prisons were generally lower than community positivity (Figure 2).
- Positivity in prisons generally followed the same trends as community positivity up until June 2021 (Delta variant period) when prison positivity did not reflect the large increase in community positivity.
- There was an uptick in prison positivity in January 2022 (Omicron BA.1 variant period) which reflected the uptick in community positivity at the same time, but at a smaller scale.

Table 1. Descriptive characteristics of COVID-19 infected individuals in prison and community settings in England, Jan 2021 – Mar 2022.

	Prisons		Community	
	n	%	n	%
Sex				
Female	1,991	7.48	7,617,488	53.92
Male	24,458	91.95	6,473,102	45.82
Age				
<10	57	0.21	1,388,694	9.83
10-19	752	2.83	2,471,316	17.49
20-29	7,650	28.76	2,286,444	16.19
30-39	8,697	32.70	2,495,552	17.67
40-49	5,138	19.32	2,189,021	15.50
50-59	2,818	10.59	1,708,457	12.09
60-69	1,007	3.79	919,322	6.51
70-79	375	1.41	469,200	3.32
≥80	106	0.40	198,317	1.40

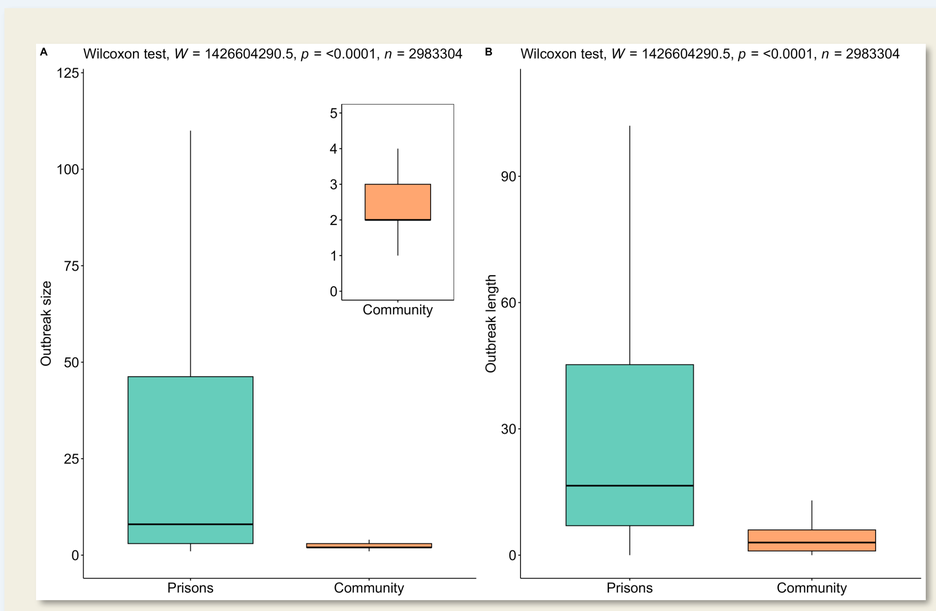

Figure 1. Distribution of **A)** outbreak sizes and **B)** outbreak lengths among prison and community settings. P-values represent differences in outbreak size and length between prison and community settings.

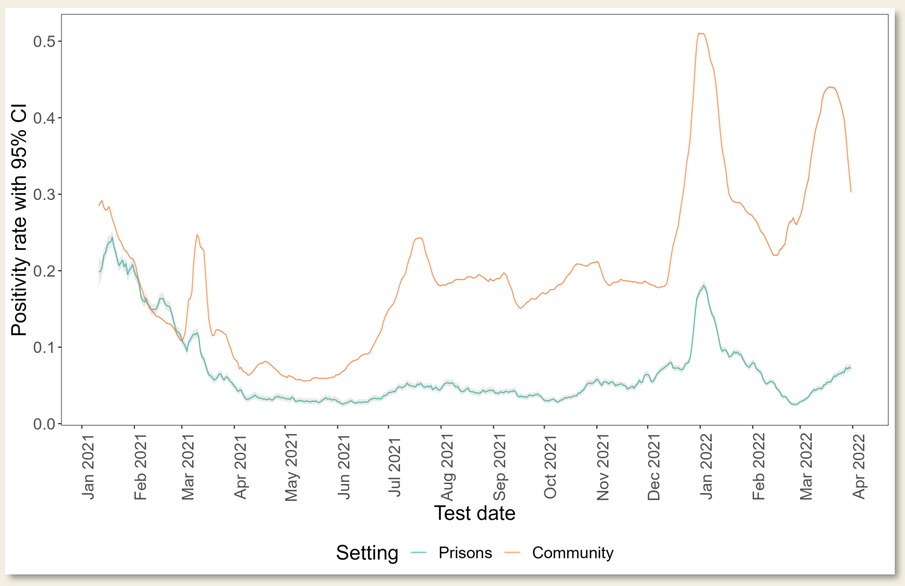

Figure 2. Positivity rates over the study period (11 Jan 2021 – 31 Mar 2022) among prison and community settings. Gray shading represents 95% confidence intervals.

DISCUSSION

- National surveillance data allows monitoring of outbreaks and positivity rates in prisons, and comparison to community settings which is key to understanding potential inequalities.
- Testing policies varied between the community and prisons. Individuals in the wider community would primarily test if they are symptomatic or have been in contact with a positive case[4], resulting in higher positivity. Prison testing guidance aimed to manage outbreaks, which resulted in increased asymptomatic testing in the prison population particularly during the Delta variant wave[5] , leading to lower positivity rates.
- The median outbreak size in prisons was relatively small when compared to the size of prison populations; this, combined with low positivity, indicates comprehensive outbreak management and testing in most prisons.
  - However, the larger outbreak size and length among the prison population compared to the wider community reflects the disparate impact of COVID-19 within the larger, more variable populations in prison settings, as well as the closed environment.
- While we have access to address-matched positive episode data, we are limited by the lack of address matching for test-level data. There may be an undercount of tests occurring in prisons and in the community; however, using previously address-matched prison postcodes should still provide a sufficient picture of prison testing across England.
- Improvements are needed to ensure reporting pathways to SGSS are robust, including complete address and location data, so that we can confidently use testing data to provide a more accurate picture of disease burden in vulnerable settings such as prisons.
  - This should be facilitated by increased collaboration with departments working directly with prisons and other vulnerable settings to better understand testing policies and behaviours in these settings.

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