Can vaccination prevent COVID-19 epidemics in Prison settings: a modelling study

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Background: Substantial outbreaks of COVID-19 illness have occurred across the world within correctional facilities including prisons, jails, and detention centres. These facilities are at particular risk of COVID-19 outbreaks due to the dynamic interactions with the wider community and the largely unavoidable close contacts that occur within these settings. Prisons are, therefore, a high priority setting for the public health response to the COVID-19 pandemic.

Methods: We developed a compartmental model of COVID-19 transmission within prison settings. In the model, epidemics can be initiated via inmates, correctional or healthcare staff, or family visitors. The model can incorporate a higher risk of mortality among vulnerable inmates. Using data of COVID-19 outbreaks in the NSW prison system during August 2021, we simulated the impact of interventions based on Personal Protective Equipment, quarantine, and isolation on the risk of outbreaks within single prisons. We then compared our results to scenarios where two-dose vaccines were rolled out to inmates and staff.

Results: Without an effective vaccine, we estimated that if one infected inmate (with the Delta variant) entered the prison, an outbreak would become established reaching a peak of 250 infections inmates (12% of the total population) on day 13. In comparison, the rapid roll out of a vaccine to reach 80% of inmates and staff would have reduced cumulative infections by 98% and almost eliminated deaths by reducing 99.8% of cumulative deaths in inmates.

Conclusion: The model closely matched the number of cases in the COVID-19 Delta variant outbreaks that occurred in an NSW prison during August 2021 under the response settings at the time. The prison-specific interventions introduced at the start of the COVID pandemic could prevent outbreaks of the original variant but were insufficient to prevent Delta variant outbreaks. A high overage of effective vaccines in inmates and staff is required to prevent future outbreaks.

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