QUANTIFYING SARS-CoV-2 INFECTION KINETICS FROM UNVACCINATED AND VACCINATED PERSONS

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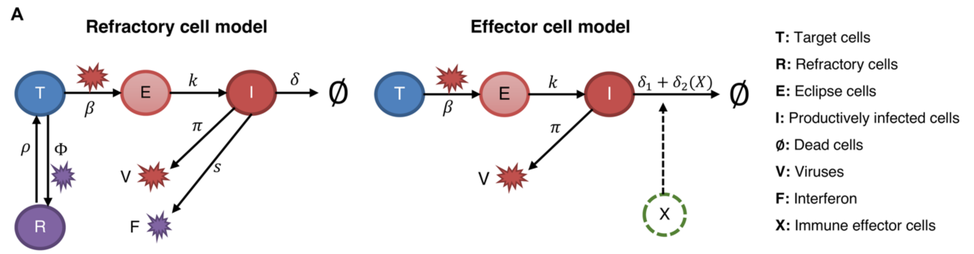
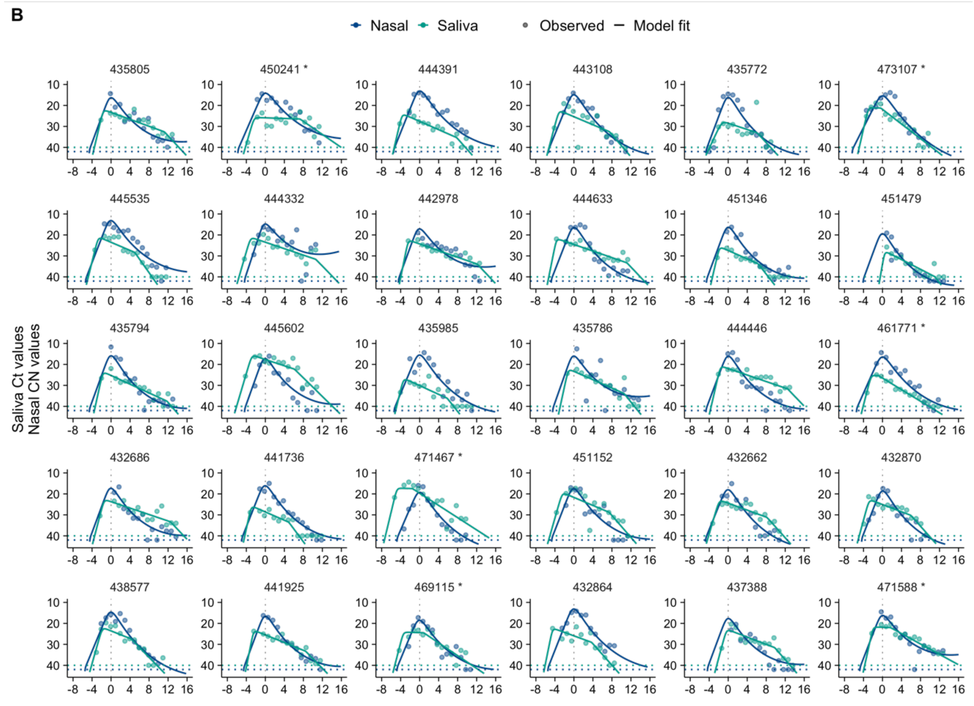
BACKGROUND

Transmission of SARS-CoV-2 is highly heterogeneous, with a small fraction of infected individuals (often referred to as "superspreaders") contributing a disproportionate share of forward transmission. However, the extent to which the underlying features of the infection process within individual hosts contribute towards the superspreading phenomenon remains unclear. In addition, it is not clear how vaccination would impact on the viral infection dynamics and thus the infectiousness of individuals.

METHODS

- In a study on UIUC and NU campus, the dynamics of infectious virus and viral RNA shedding were captured through daily longitudinal sampling of 72 individuals for up to 14 days (60 unvaccinated and 12 vaccinated).
- We fitted mechanistic models to both viral loads and cell culture positivity data, and directly estimated viral reproduction and clearance rates, and overall infectiousness for each individual.





Integrating mathematical models with viral load and cell culture positivity data, our work provides a high-resolution portrait of SARS-CoV-2 infection dynamics.

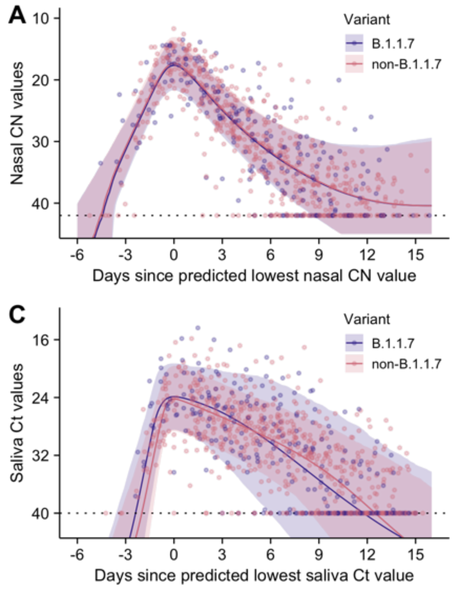
We show

- Substantial person-to-person variation in infectious virus shedding. This suggests that individual-level heterogeneity in viral dynamics contributes to superspreading.
- In unvaccinated individuals, viral loads kinetics of B.1.1.7 (Alpha) and non-variant of concern viruses were indistinguishable.
- Vaccinated individuals are much less infectious than unvaccinated individuals.

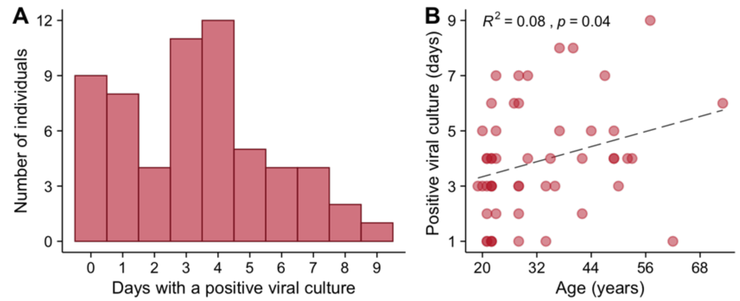
T: Target cells
R: Refractory cells
E: Eclipse cells
I: Productively infected cells
Ø: Dead cells
V: Viruses
F: Interferon
X: Immune effector cells

RESULTS

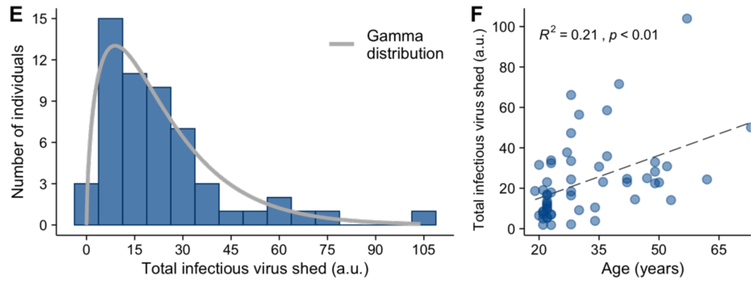
viral loads kinetics of B.1.1.7 (Alpha) and non-variant of concern viruses were indistinguishable



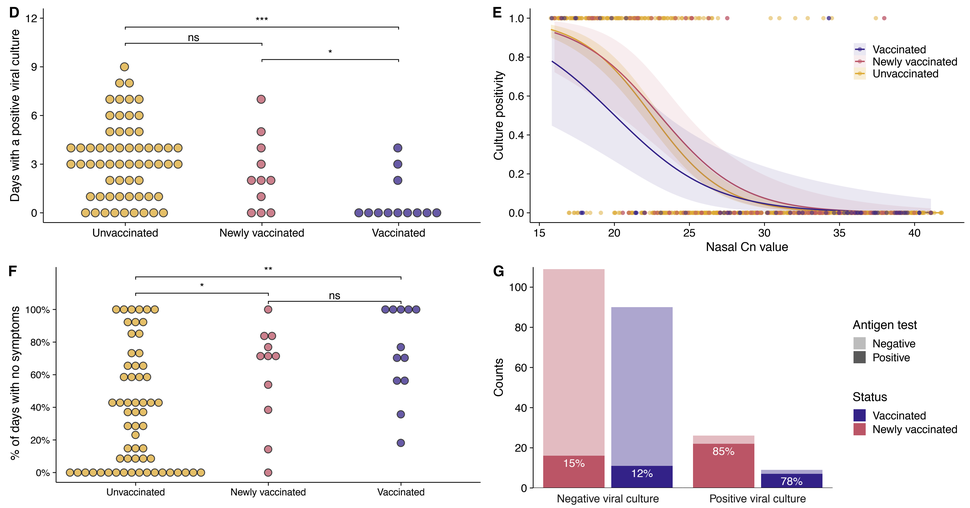
Substantial person-to-person variation in infectious virus shedding



Quantification of person-to-person variation in infectiousness



Vaccinated individuals are much less infectious than unvaccinated individuals



STUDY LIMITATIONS

- Our study cohort was limited to faculty, students, and staff and did not include anyone who was hospitalized for COVID-19.
- The results of viral culture assays performed on nasal swabs may not perfectly correlate with the actual transmission potential of an individual.
- All individual were infected by non-VOC or the Alpha variant.

FUNDING

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