



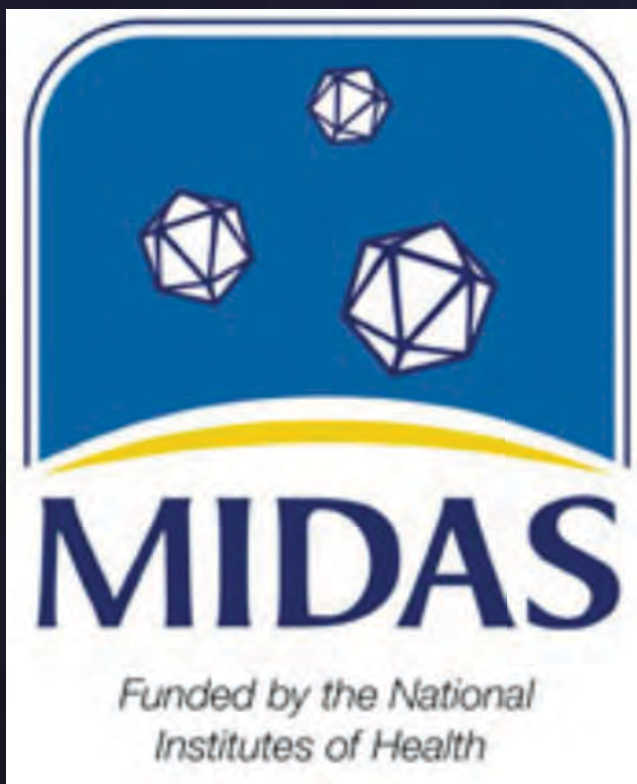
Transmission dynamics of respiratory viruses in a congregated military population: prospective cohort study

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Background

Human coronaviruses (HCoVs), rhinoviruses, and non-polio enteroviruses (NPEVs) are leading causes of seasonal acute respiratory infections among children and adults, posing significant health and economic burden annually. Despite this, little is known about their epidemiological dynamics, including the role of asymptomatic shedding in transmission; the durations of virus incubation and shedding; and the effect of immune responses on risk for re-infection during the same season. We studied respiratory virus shedding in military recruits, and used mathematical models to measure pathogen-specific transmission rates and the durations of the incubation and shedding periods.

Study design

Setting: Adult cohort entering basic training at Fort Benning, Georgia

Population: 78 soldiers in two platoons, with intense contact within platoons and regular contact between platoons in dining and training facilities

Sampling: Nasopharyngeal swabbing at enrollment and staggered biweekly intervals to monitor prevalence of viral infections during basic training via Diatherix respiratory infection panel; 463 swabs total

Surveillance for symptomatic cases: Samples from subjects with acute respiratory infection submitted for diagnostic testing using the same panel

Modeling transmission: Continuous-time Markov model of transitions between susceptible, latently infected, and infectious classes to estimate parameters of spread

Pathogen spread within cohort

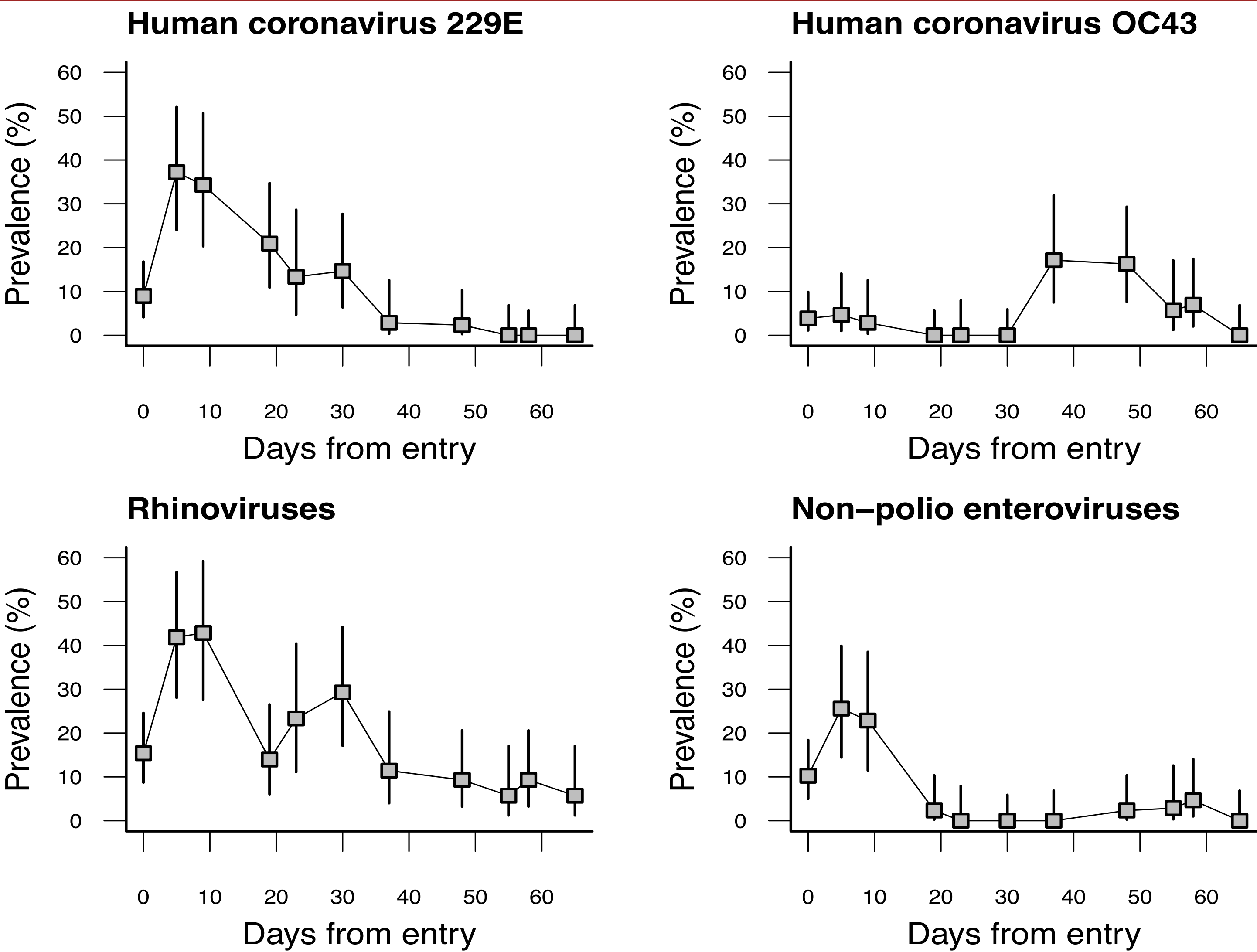


Figure: Prevalence of viruses after entry into basic training. Prevalence of the four most commonly-detected viruses, pooled within the two platoons, at the sampling dates are indicated. Vertical bars denote 95% confidence intervals around prevalence estimates.

Epidemiological parameters

	Mean time from infection to shedding onset (d)	Mean time from shedding onset to cessation (d)	Pre-epidemic reproductive number
HCoV-229E	3.11 (2.61, 3.60)	6.68 (5.15, 8.86)	5.69 (3.92, 7.98)
HCoV-OC43	3.21 (2.73, 3.70)	5.36 (3.74, 8.09)	1.97 (1.49, 2.60)
Rhinoviruses	1.81 (1.43, 2.23)	6.51 (4.82, 8.59)	5.13 (3.41, 7.35)
Non-polio enterovirus	1.19 (1.02, 2.14)	3.28 (2.30, 4.92)	2.85 (1.75, 4.38)

Table: Parameter estimates. Values estimated from the epidemiological model are presented as medians with 95% credible intervals in parentheses.

Symptomatic infections

10 cases of influenza-like illness (**12.8% attack rate**)

5 cases test positive for HCoV-229E

4 cases test positive for rhinoviruses (co-infected with HCoV-229E)

3 cases test positive for NPEV

9 cases experience symptom onset within 20 days of entering training

All cases represent the first detection of the causative agent during the study period for affected subjects

Conclusions and directions

Rapid establishment of asymptomatic spread of respiratory viruses among adults within close contact environment

HCoV-229E shows high reproductive number, duration of shedding, and burden of illness

Imperfect immune protection against re-acquisition of respiratory viruses and subsequent shedding

Possible naturally-acquired protection against acute symptoms during secondary and later infections (all cases associated with primary infections)

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