

Background

15% of people aged over 65 years live in residential care homes for the elderly (RCHE) in Hong Kong. Low SARS-CoV-2 vaccine coverage of this group and the institutional environment were considered to contribute to higher risk of infection and mortality among these residents during the Omicron BA1/2 dominated 5th wave of COVID-19. BA4/5 subvariants subsequently dominated the 6th wave, showing immune escape capacity. Comparing epidemics between the vulnerable RCHE residents and general population would improve our understandings of risk factors and inform future practices in pandemic controls.

Objectives

- To compare the infections and severity in each wave, by depicting epidemics of general population in Hong Kong and only within RCHE residents.
- To explore potential factors (e.g., demographic factors, vaccination condition) that may be related to RCHE infections during each wave.

Methods

We obtained data on daily infection cases from Hong Kong and within RCHE residents only from Center for Health Protection, including demographic and vaccination conditions. We first characterize the population level epidemics, using both all COVID-19 cases in Hong Kong and among RCHE residents, to compare cases distribution during the waves 5 and 6. We also compared epidemiological parameters among these two populations, including infection rate (Confirmed cases divided by total Hong Kong population number or RCHE residents number) and case fatality rate (CFR, confirmed deaths divided by cases).

We estimated the vaccine effectiveness against deaths relative to any infection among RCHE residents by fitting logistic regression on PCR or rapid antigen test (RAT) confirmed COVID-19 deaths to vaccine conditions, with adjustment for demographic factors including age, sex and residential districts. We also estimated the odds of death in relation with the vaccination doses and types.

Results

During wave5 and 6 (2021-12-31 to 2022-12-31), 41786 RCHE residents were confirmed with COVID-19, accounting for 1.6% and 8.9% of all cases and cases older than 65 years in Hong Kong, respectively. Unlike the general population that experiencing three waves (5, 6a and 6b), RCHEs only experienced infection peaks in waves 5 and 6b, with no obvious peak in wave 6a (**Fig. 1**). During wave 5, monthly incidence for RCHE residents peaked in March, in which 440 per 1000 people are infected, before decreasing to 0.1 per 1000 in May.

Partial individual data of confirmed cases among RCHE residents were obtained. In each wave, more infected RCHE residents chose to vaccinate inactivated vaccines instead of mRNA (**Tab. 1**).

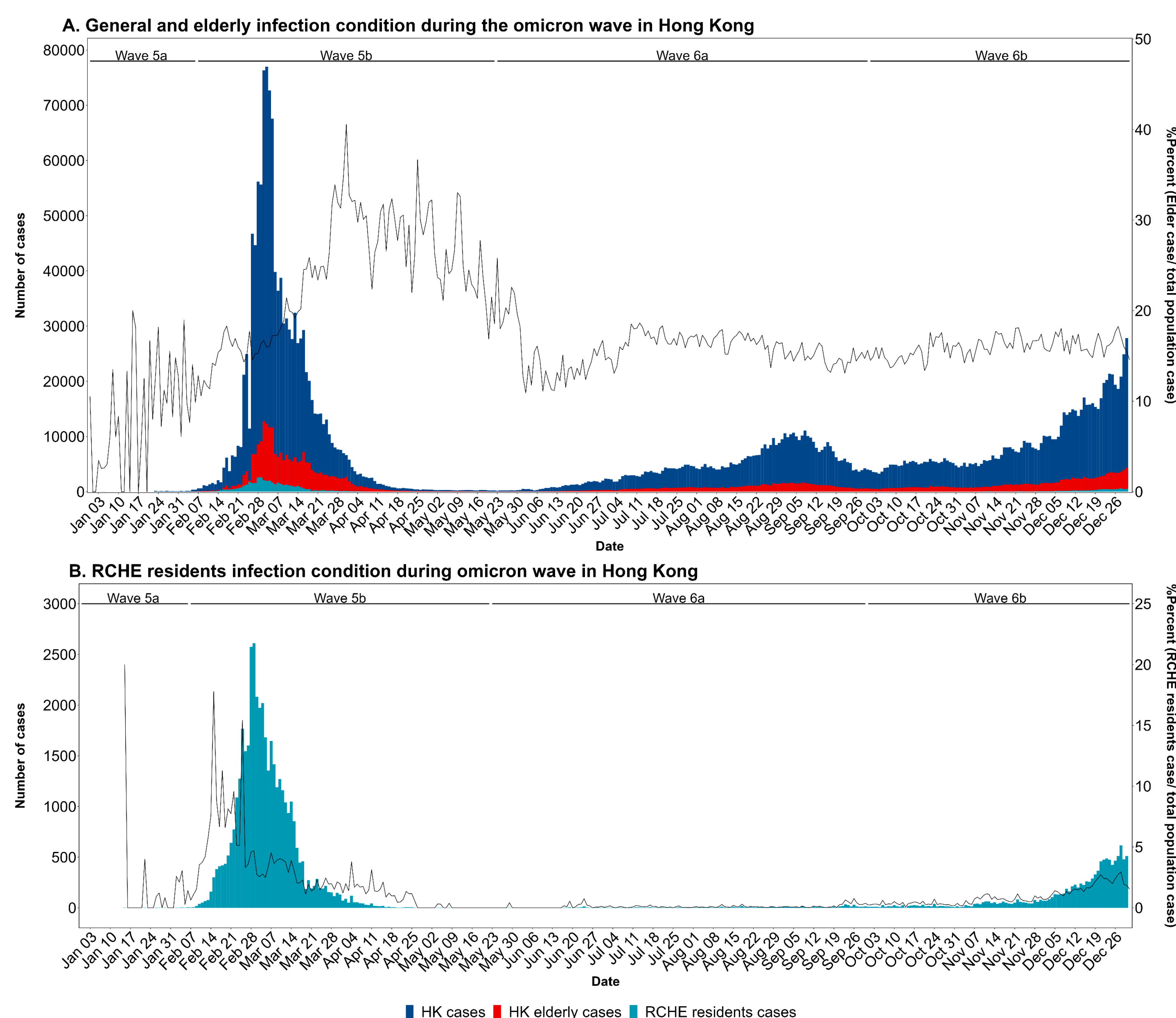


Figure1. Populational level infection condition in Hong Kong (A) and within RCHE only (B) during wave omicron

Table1. Summary of demographic and vaccination conditions of RCHE residents confirmed with COVID-19

	Wave 5a (2021-12-31 to 2022-02-06) (n=12)	Wave 5b (2022-02-07 to 2022-05-22) (n=27275)	Wave 6a (2022-05-23 to 2022-09-30) (n=45)	Wave 6b (2022-10-01 to 2022-12-31) (n=68)
Age				
Median (IQR)	88.0 (82.5, 86.3)	86.0 (77.0, 91.0)	88.0 (82.0, 92.0)	86.5 (78.0, 92.0)
Sex				
Female (%)	7 (58.3)	14881 (55.1)	23 (51.1)	39 (57.4)
Male (%)	5 (41.7)	12122 (44.9)	22 (48.9)	29 (42.6)
Chronic disease				
Yes (%)	12 (100)	142 (0.5)	1 (2.2)	0 (0)
No (%)	0 (0)	27133 (99.5)	44 (97.8)	68 (100)
Vaccination				
Dose				
2	0 (0)	5183 (19.0)	17 (37.8)	3 (4.4)
3	0 (0)	435 (1.6)	19 (42.2)	55 (80.9)
4	0 (0)	0 (0)	0 (0)	6 (8.8)
Type				
BNT162b2	0 (0)	603 (2.2)	1 (2.2)	3 (4.4)
Inactivated	0 (0)	4973 (18.2)	28 (62.2)	51 (75.0)
Mix-up	0 (0)	40 (0.2)	4 (8.9)	3 (4.4)
Death (CFR)				
	0 (0)	4866 (17.8)	4 (8.9)	1 (1.5)
Test method				
PCR (%)	12 (100%)	17663 (64.8)	41 (91.1)	58 (85.3)
RAT (%)	0 (0)	9612 (35.2)	4 (8.9)	10 (14.7)

1564 (32.1%) out of 4875 deaths of RCHE residents have been vaccinated with at least two doses during the recorded period. CFR in wave 5b has reached to 17.8%, which is higher than that (0.8%) of total infected cases in HK at the same period. Within wave 5b, the relative primary series vaccine effectiveness (VE) against death in comparison of infection only is 56% (95%CI 51-60%), adjusted for demographic factors. The relative VE against death also increases with more vaccination doses and shows significant difference regarding vaccination types.

Table2. Relative vaccine effectiveness against death in comparison with infection regarding vaccination doses primary series vaccination types

	Relative vaccine effectiveness
Overall	
Vaccination (primary series)	55.9 (51.5, 60.0)
Dose	
Unvaccinated	ref
1	43.2 (38.5, 47.4)
2	60.9 (56.8, 64.7)
3	82.5 (73.3, 89.3)
Type of primary series vaccination	
BNT162b2	73.2(61.3, 82.2)
Inactivated	51.9 (46.9, 56.6)

Conclusion

Cases among RCHE residents have peaked in both wave 5b and 6b but escaped wave 6a. From individual-level analysis, the relative VE against death compared to infection is 56%. More doses of vaccination help improve this relative VE. BNT162b2 have shown a greater relative protection against death compared to that of inactivated vaccination

References

[1] Leung MHJ *et al.*, 2023 *Infect Med (Beijing)*, 2(1).

Acknowledgements

This project was supported by the HMRP Commissioned Research (CID-HKU2-15).