

Seroprevalence of COVID-19 in healthcare workers in Hong Kong: a longitudinal cohort study (HCW study)

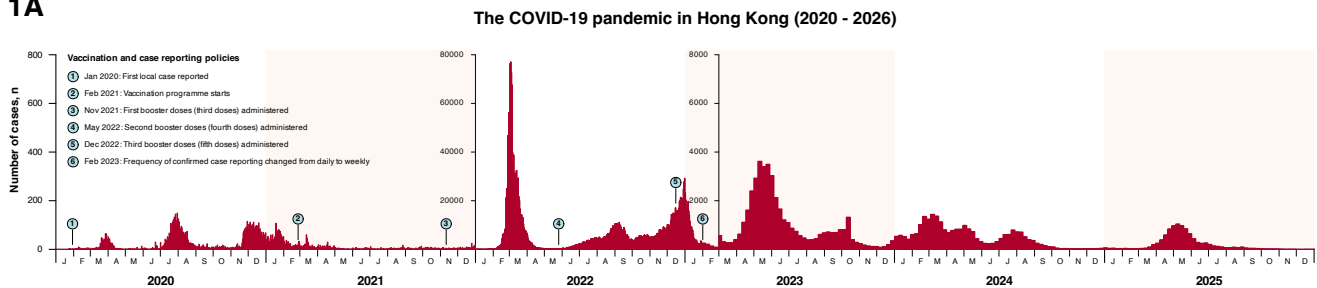
The Hong Kong healthcare worker cohort (2020–2026)

The HCW study was established in 2020 as a prospective cohort study among healthcare workers in Hong Kong to estimate the seroprevalence of SARS-CoV-2 antibodies, evaluate vaccine immunogenicity and effectiveness, and assess the durability of SARS-CoV-2 protection induced by vaccination and infection.^{1,2} Supported by two grants from the Health and Medical Research Fund of the Health Bureau, we enrolled 1,752 participants and collected 16,875 blood samples over the course of the study. With your support, we have been able to map SARS-CoV-2 epidemiology in healthcare workers, measure the performance of mRNA and inactivated COVID-19 vaccines, and understand the durability of immunity against infections and re-infections across distinct phases of the pandemic.

COVID-19 epidemiology in Hong Kong

In 2020 and 2021, Hong Kong experienced several waves of SARS-CoV-2 infections, which were effectively contained through stringent public health interventions.³ Our analyses showed that fewer than 1% of participating healthcare workers had been infected by December 2021.¹ Vaccines were available since early 2021, and most participants had received two doses by August 2021 and a third dose by May 2022 (see Figure 1, panel B below).

1A



1B

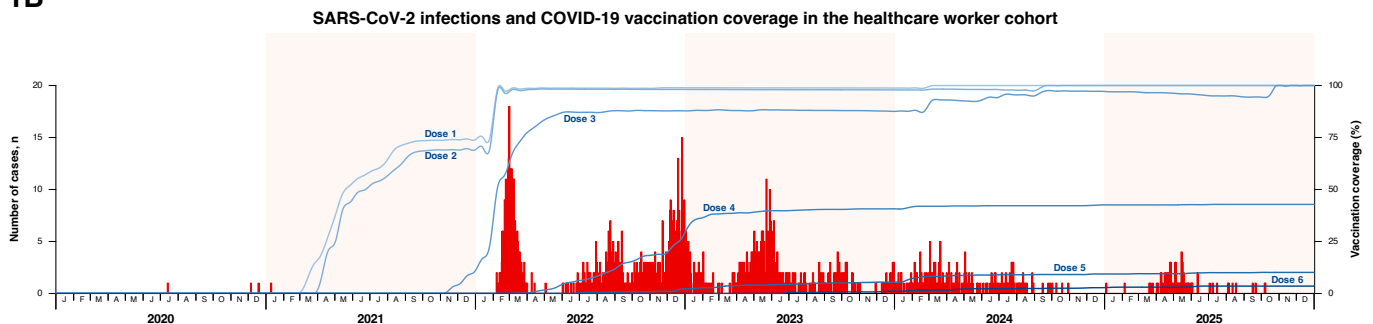


Figure 1. Panel A: Confirmed SARS-CoV-2 cases in Hong Kong. Panel B: Cases reported in the cohort and changes in vaccination uptake over time.

Tracking immunity through successive boosters

While our early work focused on the primary series,² the multi-year timeline of this study allowed us to examine the antibody responses beyond the third dose. As visualized in Figure 2 panel A, participants in our cohort received up to 8 doses of COVID-19 vaccines over the six-year period to maintain protection. Our laboratory analysis of these samples, highlighted in Figure 2 panel B, provided insights into how immune systems responded to emerging variants:

- **Broadening Protection:** We tracked neutralizing and binding antibodies not only against the ancestral strain but against highly mutated variants like BA.5 and JN.1.
- **The Booster Effect:** Antibody levels reached very high peaks following the fourth, fifth, and sixth doses, indicating that the immune system remained highly responsive to repeated boosting.
- **Vaccine Performance:** While CoronaVac stimulated lower antibody levels than BNT162b2, separate studies have shown that it still provided robust effectiveness against severe disease.

Antibody waning and hybrid immunity

Figure 2C maps out a critical reality of COVID-19 immunity: anti-SARS-CoV-2 antibodies wane over time. This decline is noticeable within 3 to 6 months, particularly following CoronaVac vaccination. However, the data also revealed that natural breakthrough infections provided a generally stronger and longer-lasting antibody response. By sharing these insights with health authorities, this cohort directly accelerated the government’s November 2021 recommendation for third doses of COVID-19 vaccines to be administered, directly protecting the wider Hong Kong community.

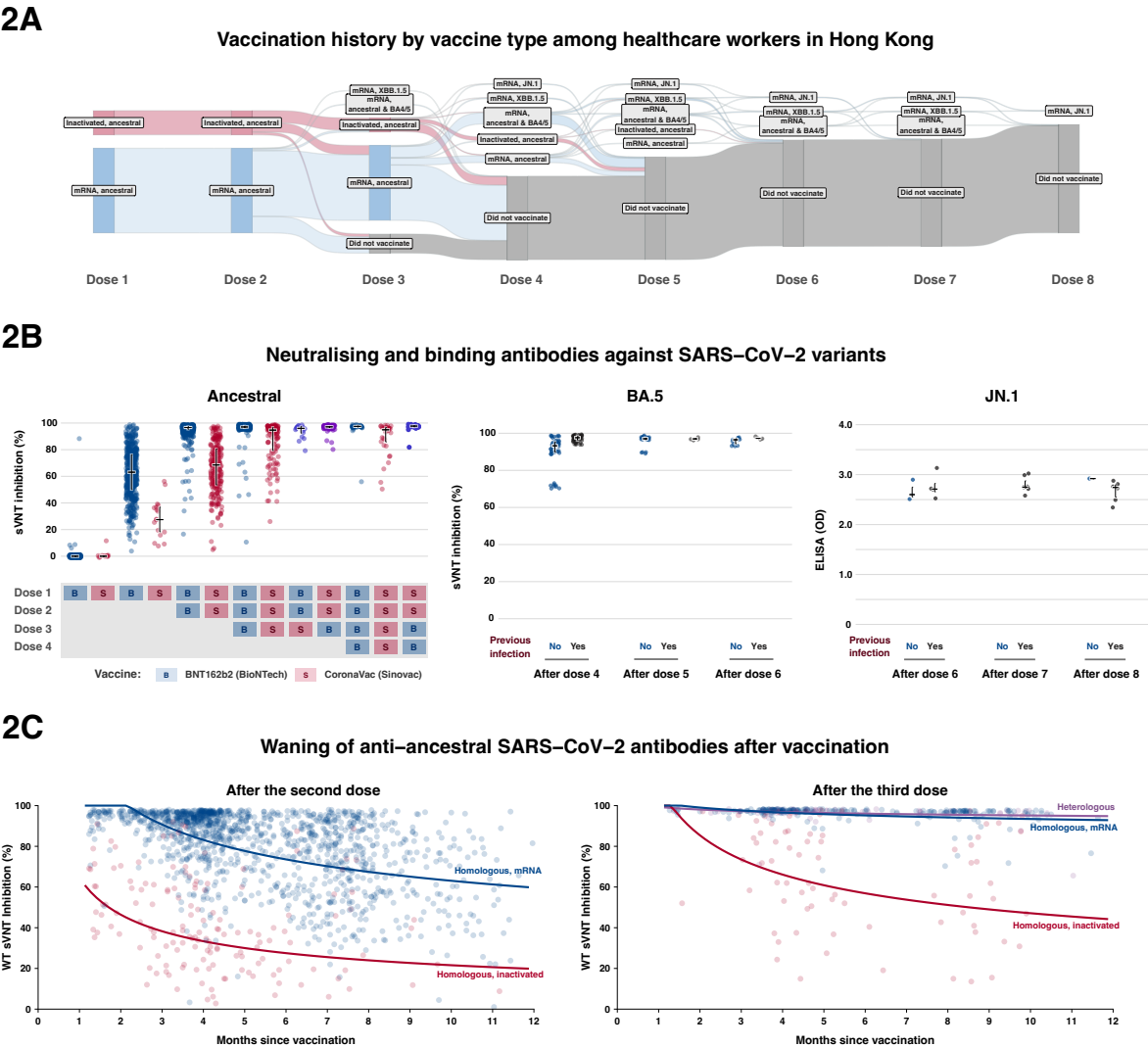


Figure 2. Vaccination history (panel A), vaccine immunogenicity (panel B), and waning of anti-SARS-CoV-2 antibody after COVID-19 vaccination (panel C) among cohort participants.

What we are working on next

The blood samples you provided will continue to be an invaluable scientific resource. We are continuing to analyze samples and data collected in this study, with publications in preparation on the vaccine effectiveness of successive booster doses, the impact of hybrid immunity, reinfection rates after different vaccination or infection histories, and patterns in antibody dynamics after infections and re-infections.

Thank you for your participation in this study over the past 6 years! We truly appreciate your support!

References

- 1 Lim WW, Mak L, Ho F, *et al*. Seroprevalence of COVID-19 among healthcare workers in Hong Kong during the first 2 years of the COVID-19 pandemic (2020–2021): a longitudinal cohort study. *BMJ Open* 2026; **16**: e110192.
- 2 Lim WW, Mak L, Leung GM, Cowling BJ, Peiris M. Comparative immunogenicity of mRNA and inactivated vaccines against COVID-19. *Lancet Microbe* 2021; **2**: e423.
- 3 Yang B, Lin Y, Xiong W, *et al*. Comparison of control and transmission of COVID-19 across epidemic waves in Hong Kong: an observational study. *Lancet Reg Health West Pac* 2024; **43**: 100969.
- 4 Leung NHL, Cheng SMS, Cohen CA, *et al*. Comparative antibody and cell-mediated immune responses, reactogenicity, and efficacy of homologous and heterologous boosting with CoronaVac and BNT162b2 (Cobovax): an open-label, randomised trial. *Lancet Microbe* 2023; **4**: e670–82.
- 5 McMenamin ME, Nealon J, Lin Y, *et al*. Vaccine effectiveness of one, two, and three doses of BNT162b2 and CoronaVac against COVID-19 in Hong Kong: a population-based observational study. *Lancet Infect Dis* 2022; **22**: 1435–43.

香港醫護人員 2019 冠狀病毒病的血清陽性率：前瞻性追蹤隊列研究

香港醫護人員前瞻性隊列研究(2020 – 2026)

「HCW 研究」是一項由 2020 年起展開、以香港醫護人員為對象的前瞻性隊列研究。本研究旨在估算醫護人員中新型冠狀病毒（SARS-CoV-2）抗體的血清陽性率、評估新冠疫苗的免疫原性與有效性，並探討接種新冠疫苗及感染新冠病毒後所產生保護的持久性。^{1,2} 在醫務衛生局轄下的「醫療衛生研究基金」所提供的兩項資助下，我們成功招募了 1,752 名參加者，並在研究期間收集了 16,875 份血液樣本。感謝閣下的卓越支持，使我們能夠了解香港醫護人員群組中，新冠病毒的流行病學特性、兩種新冠疫苗（信使核糖核酸疫苗與滅活疫苗）的免疫原性表現，以及於新冠病毒病大流行的不同階段下，針對初次感染與再次感染的免疫保護持久性。

香港「2019 冠狀病毒病（COVID-19）」的流行病學

香港於 2020 至 2021 年間經歷了數波新冠疫情，然而透過嚴格的公共衛生干預措施，疫情均獲得有效控制。³ 根據本研究分析顯示，截至 2021 年 12 月，僅有不到 1% 的參與研究醫護人員曾感染 COVID-19。¹ 自 2021 年初新冠疫苗開始供應後，大多數參加者已於 2021 年 8 月前完成接種兩劑新冠疫苗，並在 2022 年 5 月前接種了第三劑疫苗。（見圖 1B）。

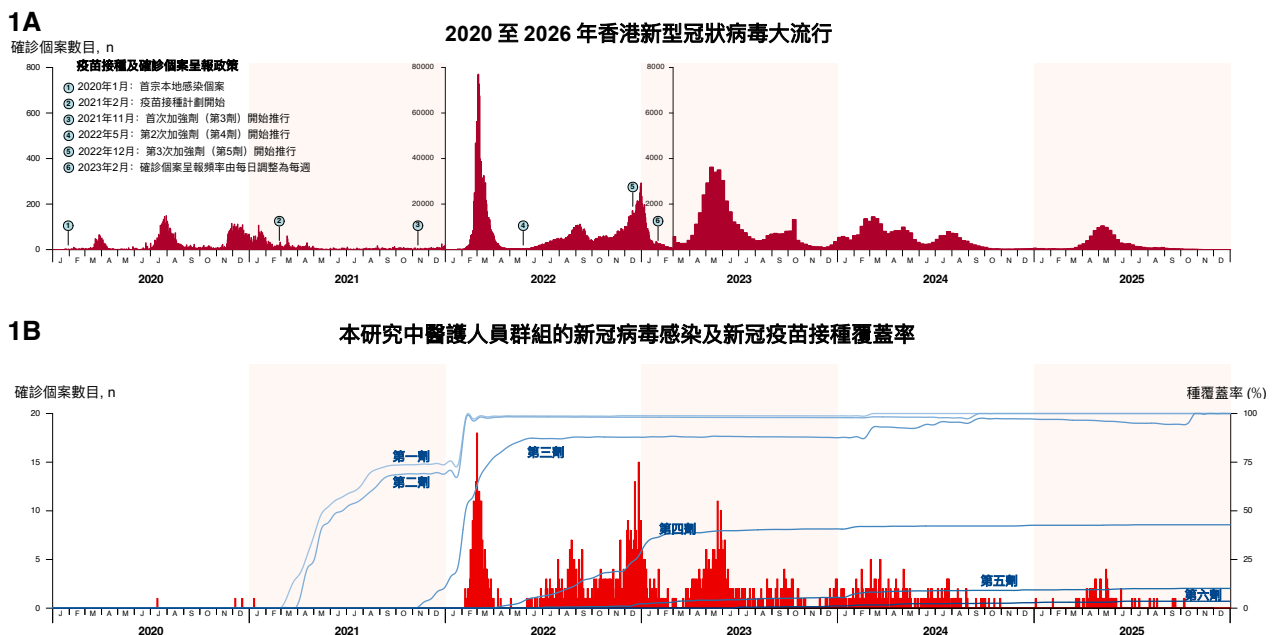


圖 1. 【A】香港確診新冠病毒病個案趨勢。【B】本研究中參加者通報的確診個案及疫苗接種率隨時間變化趨勢。

追蹤後續加強劑的免疫表現

雖然我們早期的工作集中於基礎免疫劑次，² 但本研究跨越多年的時間線使我們能夠深入探討第三劑以後的抗體反應。正如圖 2A 的疫苗接種史所示，本隊列的參加者在六年期間接種了多達 8 劑新冠疫苗以維持保護力。我們對這些樣本進行的實驗室分析（如圖 2B 所示）為免疫系統如何應對新興變異株提供了關鍵見解：

- 開拓更廣泛的保護力：我們不僅追蹤了針對原始株的探討，更針對具高度突變的變異株（如 BA.5 和 JN.1）進行了中和及結合抗體的分析。
- 加強劑效應：抗體水平在接種後續加強劑（特別是第四、第五和第六劑）後達到了極高值，證明免疫系統對重複接種加強劑仍能保持高度反應。
- 疫苗效能表現：儘管科興疫苗（CoronaVac）引發較低的絕對抗體水平低於復必泰（BNT162b2），但獨立數據證實其在預防感染及重症方面仍維持高度有效性。

抗體減弱趨勢與混合免疫成效

圖 2C 描繪了新冠病毒免疫力的一項關鍵現實：抗 SARS-CoV-2 抗體會隨時間呈一定程度的下降，這在接種科興疫苗後的 3 至 6 個月內尤為明顯。然而，數據亦顯示了由自然突破性感染所產生的抗體反應，通常更強、結構更多元，且具更長久的保護效益。透過與衛生當局分享本研究的發現，本隊列研究直接促成了政府於 2021 年尾建議接種第三劑新冠疫苗的決策，從而直接保護更廣泛的香港社區。

