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COVID-19 Breakthrough Infections Among People With and Without HIV: A Statewide Cohort Analysis

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BACKGROUND

- Despite the remarkable efficacy of COVID-19 vaccines, some fully vaccinated individuals will develop breakthrough infections.
- Immunocompromised populations might be more prone to breakthrough infections, such as people with HIV (PWH).
- The evidence of vaccine efficacy among PWH is scarce because of the small number of studies and under-representativeness in the clinical trials of COVID-19 vaccine efficacy.

AIMS

- This study aims to characterize and compare breakthrough COVID-19 infections (e.g., prevalence and disease severity) between PWH and a propensity score matched (PSM) group of people without HIV (PWoH) and examine whether different immunity levels of PWH play a role in COVID-19 vaccine effectiveness.

METHODS

- This is a statewide population-based cohort study, with data being retrieved from an integrated system of electronic health record (EHR) data of HIV cohort and COVID-19 cohort in South Carolina (SC).
- Both crude and adjusted hazard ratios were calculated using Cox proportional hazard (PH) regression models accounting for potential confounders such as vaccine brands, booster dose, prior COVID-19 diagnosis, and calendar period differentiated by different dominant variants of concern (e.g., Delta, Omicron).

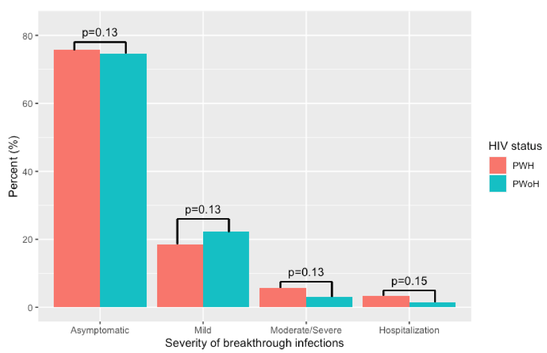

Figure 1 Severity of breakthrough infections between PWH and PWoH

Compared to PWoH, PWH did not have an elevated risk of breakthrough infection rate, regardless of different immunity levels. Yet PWH had a higher risk of breakthrough infection compared to PWoH if they did not receive a booster dose.

RESULTS

- Among a total of 2,144,415 participants, 8,335 were PWH and 2,136,080 were PWoH before PSM.
- No significant differences of severity of breakthrough infections were observed between PWH and PWoH (Figure 1).
- After PSM, HIV status was not associated with breakthrough infection in either the crude or adjusted models (Figure 2). However, in the subgroup of individuals without any booster dose, PWH were more likely to experience a breakthrough infection than PWoH (aHR: 1.19; 95%CI: 1.03-1.39)
- Other significant variables include: prior COVID-19 infection before full vaccination (aHR, 0.37; 95%CI: 0.28-0.48), receipt of a booster dose (aHR, 0.21; 95%CI: 0.15-0.30)

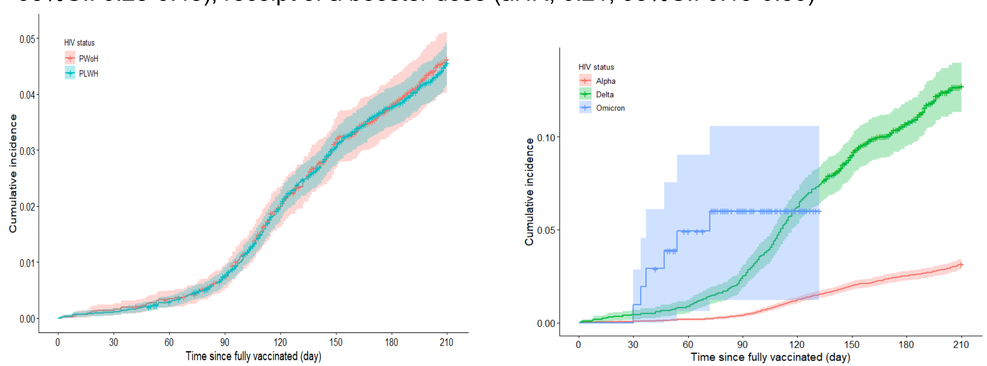

Figure 2 Cumulative incidence of COVID-19 breakthrough infections stratified by HIV status and different variants of concerns

RESULTS (continued')

- The risk of breakthrough infection was substantially higher during the Delta (aHR, 4.40; 95%CI: 3.80-5.08) and Omicron (aHR, 7.02; 95%CI: 3.12-15.80) variant dominant periods relative to the Alpha dominant period.
- Compared to PWoH, PWH with lower CD4 counts (<200 cells/mm3) or viral load >200 copies/ml at full vaccination had a higher cumulative incidence of breakthrough infections, although these trends were not statistically significant.

CONCLUSIONS

- Our findings do not support a broad conclusion that COVID-19 vaccine effectiveness is lower among PWH, while we did find that PWH had a higher risk of breakthrough infection compared to PWoH if they did not receive a booster dose.
- This finding is supportive of CDC's recommendation of an additional booster dose (as primary series of vaccine) for immunocompromised populations.
- Contrary to the hypothesis, moderate or severe immune suppression or unsuppressed HIV viral load does not necessarily manifest a less rigorous responses to COVID-19 vaccination.

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