**Similar effectiveness of the inactivated vaccine BBIBP-CorV (Sinopharm) and the mRNA vaccine BNT162b2 (Pfizer-BioNTech) against COVID-19 related hospitalizations during the Delta outbreak in the United Arab Emirates**

**Effectiveness of COVID-19 Vaccines on Delta Variant**

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*Highlights*

Inactivated vaccine BBIBP-CorV (Sinopharm; 95% (95%CI: 94%,97%)) and the mRNA vaccine

BNT162b2 (Pfizer-BioNTech; 98% (95%CI: 86%,99%)) demonstrated protection against

COVID-19 related hospitalizations from the Delta (B.1.617.2) variant. Ongoing efforts are

necessary to target vaccine hesitancy and promote booster shots for protection against severe COVID-19 disease and arising variants of concern.

**Similar effectiveness of the inactivated vaccine BBIBP-CorV (Sinopharm) and the mRNA vaccine BNT162b2 (Pfizer-BioNTech) against COVID-19 related hospitalizations during the Delta outbreak in the United Arab Emirates**

The United Arab Emirates (UAE) implemented swift and proactive mitigation measures to combat the COVID-19 pandemic. While there are currently five primary approved vaccines in the UAE, inactivated vaccine BBIBP-CorV (Sinopharm), which has a 78% effectiveness in preventing hospitalization due to COVID-19 infections[1], and mRNA vaccine BNT162b2 (Pfizer-BioNTech), with an effectiveness at 93% in preventing hospitalization due to COVID-19 infections[2], are most commonly administered. Due to the successful early COVID-19 vaccination rollout, approximately 91.6% of the population has been vaccinated, which is mainly attributed to a model governance system, logistical capabilities, accessibility and delivery, digital infrastructure, and vaccine manufacturing facility[3].

With the Delta (B.1.617.2) variant predominance across the world, emerging reports describe the breakthrough of SARS-CoV-2 infections in fully vaccinated individuals. This is particularly concerning as the original strain of SAR-CoV-2 has an $R_0$ of 2.5, while the delta variant has an $R_0$ of 5[4]. We will present the impact of vaccination effectiveness on admission to hospital in patients with confirmed SARS-CoV-2 infection during Delta (B.1.617.2) variant predominance in the UAE, particularly when administered in real-world conditions. Randomized community and intensive care unit facilities with targeted methods of sample collection of RT-PCR positive specimens are adopted following the EUCDC model to control misclassification and ascertainment bias[5]. Samples were collected from residents across the Northern Emirates from August-

November 2021. Viral genome sequencing was performed on all specimens to confirm the variant details following the best practices and instructions recommended by the Broad Institute's Genome Analysis ToolKit (GATK)[6]. SARS-CoV-2 vaccination status was recorded, including the specific vaccine type (BNT162b2, Pfizer–BioNTech; BBIBP-CorV, Sinopharm). Patients were considered fully vaccinated if the final dose was administered ≥14 days before symptom onset or a positive PCR test for SARS-CoV-2 and were partially vaccinated if the individuals who received only one dose was ≥14 days or <14 days for individuals who received two doses. Patient status was recorded, including asymptomatic/mild patients that were quarantined at home, or moderate/severe/deceased patients that were hospitalized. The statistical analysis was conducted as a bivariate case-control panel, with controls characterized as non-hospitalized patients and cases characterized as hospitalized patients associated to COVID-19. Pearson $\chi^2$ for descriptive statistical test and multivariate logistic regression models, adjusted for age (continuous) and sex, were used. Vaccine effectiveness estimation was adjusted for the covariates and derived from the regression model (1-OR) expressed as percentage.

In total, 3782 samples were collected and sequenced, with an average age of 32.76 (SD: 19.10), 52.7% were males (n=1993) and 47.0% were females (n=1777). Most individuals were asymptomatic/mild (84.1%, n=2792) and were quarantined at home, with the rest of the patients developed moderate/severe symptoms (15.9%, n=528) that were admitted at the hospital. A total of 96.3% (n=3641) patients carried the Delta variant, demonstrating the predominance of the variant of concern at the time of sampling. Of those, 49.7% (n=1559) patients were not vaccinated, 4.6% (n=144) were partially vaccinated, and 45.7% (n=1433) were fully vaccinated. Most of the vaccinated individuals received either BBIBP-CorV (Sinopharm; 91.2%, n=1486) or mRNA BNT162b2 (Pfizer-BioNTech; 8.0%, n=130) vaccines. A total of 5.7% (n=81) of fully vaccinated

patients, 16.1% (n=23) of partially vaccinated, and 24.1% (n=373) of non-vaccinated patients were admitted to the hospital.

When evaluating vaccine effectiveness against the Delta (B.1.617.2) variant (Table 1), individuals partially vaccinated with BBIBP-CorV (Sinopharm) and mRNA BNT162b2 (Pfizer-BioNTech) demonstrated 62% (95% CI: 29%, 79%) and 83% (95% CI: 45%, 94%) vaccine effectiveness against hospital admission, respectively. Fully vaccinated individuals vaccinated with BBIBP-CorV (Sinopharm) and mRNA BNT162b2 (Pfizer-BioNTech) showed a 95% (95% CI: 94%, 97%) and 98% (95% CI: 86%, 99%) of effectiveness, respectively, on preventing hospitalization and critical admissions due to COVID-19. There were no hospitalizations reported due to COVID-19 of the 62 participants that received a booster shot (BBIBP-CorV, Sinopharm, n=48; BNT162b2 Pfizer-BioNTech, n=2; BBIBP-CorV Sinopharm and BNT162b2 Pfizer-BioNTech, n=13).

These interim vaccine effectiveness findings for both BBIBP-CorV (Sinopharm) and mRNA BNT162b2 (Pfizer-BioNTech) vaccines in real-world conditions complement and expand upon the vaccine effectiveness estimates from the delta variant, demonstrating significant preventive benefits in protection from COVID-19-related hospitalization. Vaccine effectiveness is not only determined by novel mutations in the virus spike protein to escape immunity, but also the association of T-cell mediated immunity and binding antibodies among other factors. Due to the limited availability of some data on potential confounders, caution is advised for data interpretation. Larger retrospective clinical studies should investigate the vaccine effectiveness to variants of concerns, long-term complications, and stratification of vaccine effectiveness by cofactors. Ongoing efforts are necessary to target vaccine hesitancy and promote booster shots, when necessary, for protection against severe COVID-19 disease and arising variants of concern, such as the Omicron variant.

*Author Contributions*

HA and AF conceived the project to study the role of the virus and host in COVID-19 in the United Arab Emirates to allow for a multi-centered approach to study the contribution of the SARS-CoV-2 virus and its human host to the COVID-19 disease in the UAE. MM, MA, AF and HA conceived the central research questions. HA, FA, SA, NA, TA, HA, and AF defined the sampling strategy, managed the sample collection and preparation process from consenting patients, RNA extraction and the delivery of samples to the laboratory. MA built the bio-informatics pipeline for variant calling and genomic epidemiology, developed code for data pre-processing. MM analyzed the results and initiated the first draft of the manuscript. All authors on the primary list contributed to the data interpretation and critically reviewed the manuscript and approved the final manuscript for submission.

*Conflict of Interest*

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

*Acknowledgments*

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Table 1. Adjusted vaccine effectiveness estimates of BBIBP-CorV and BNT162b2 vaccines after partial vaccination and full vaccination.

| Vaccine Status | Non-Hospitalized | Hospitalized | *p*-value | Crude OR (95% CI) | *p*-value | Adjusted OR (95% CI) | *p*-value | Vaccine Effectiveness (95% CI) |
|---|---|---|---|---|---|---|---|---|

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **No Vaccination** | | 1174 (75.9%) | 373 (24.1%) | | Ref | | Ref | | NA |
| **Partial Vaccination** | BBIBP-CorV | 92 (82.1%) | 20 (17.9%) | 0.133 | 0.68 (0.41, 1.12) | 0.135 | 0.45 (0.25, 0.81) | 0.008 | 62% (29%, 79%) |
| | BNT162b2 | 28 (90.3%) | 3 (9.7%) | 0.062 | 0.34 (0.11, 1.12) | 0.075 | 0.13 (0.04, 0.46) | 0.002 | 83% (45%, 94%) |
| **Full Vaccination** | BBIBP-CorV | 1197 (93.7%) | 80 (6.3%) | <0.001 | 0.21 (0.16, 0.27) | <0.001 | 0.05 (0.03, 0.06) | <0.001 | 95% (94%, 97%) |
| | BNT162b2 | 85 (98.8%) | 1 (1.2 %) | <0.001 | 0.04 (0.01, 0.27) | <0.001 | 0.02 (0.01, 0.14) | <0.001 | 98% (86%, 99%) |

CI, Confidence Interval; NA, Not Applicable; OR, Odds Ratio; Ref, Referent Group.

Partial Vaccination: >14 days for individuals who received only one dose and <14 days for individuals who received two doses

Full Vaccination: ≥ 14 days for individuals who received two doses

Chi-squared test of significance was used to measure associators between no vaccination and each category in the model

Bivariate analysis (non-hospitalized vs. hospitalized) was used for the regression models, presented as crude OR and adjusted OR for age and sex

Vaccine effectiveness estimation was adjusted for the covariates, age, and sex, and derived from the regression model (1-OR) expressed as percentage.