Impacts of Different SARS-CoV-2 Variants on Hospital Usage and Performance in the United Arab Emirates: A Comparison among Alpha, Delta and Omicron

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Background

- Alpha, delta and omicron variants of SARS-CoV-2 attacked the United Arab Emirates in 2020, 2021 and 2022 respectively.
- This study evaluates how these three variants affect hospital usage and performance in the United Arab Emirates.

Models

Original Least Squares

$$outcome = \beta_0 + \beta_1 alpha + \Sigma\beta_2 X + \varepsilon$$

$$outcome = \alpha_0 + \alpha_1 delta + \Sigma\alpha_2 X + \mu$$

$$outcome = \delta_0 + \delta_1 omicron + \Sigma\delta_2 X + \rho$$

β_1: the effect of alpha variant
α_1: the effect of delta variant
δ_1: the effect of omicron variant
outcome: bed occupancy rate, hospital mortality rate
X: covariates
$\sum\beta_2$, $\sum\alpha_2$ and $\sum\delta_2$: coefficients of covariates
β_0, α_0 and δ_0: constant terms
ε, μ and ρ: error terms

Variables

Hospital usage

- Measurement
  bed occupancy rate
- Calculation
  rate = utilised beds / available beds

Hospital performance

- Measurement
  hospital mortality rate
- Calculation
  rate = (actual deaths in hospital / expected deaths in hospital) * 100

Data

Database

- Open Data of the Emirates Health Services

Sample

- 16 hospitals across five emirates including Dubai, Sharjah, Umm Al Quwain, Ras Al Khaimah and Fujairah

Statistics

Table 1 Mean values of key variables

	Bed occupancy	Hospital mortality
2020	0.557 (0.159)	0.053 (0.040)
2021	0.643 (0.160)	0.068 (0.065)
2022	0.644 (0.185)	0.043 (0.049)

Note: Standard errors in parentheses.

- The bed occupancy rate slightly increased with time.
- The hospital mortality rate rose at first, reaching the highest in 2021, and then dropped to the lowest in 2022.

Results

Result 1

- Alpha outbreak reduces bed occupancy by 8.96%.
- Delta and omicron outbreaks increase bed occupancy by 4.80% and 4.16% respectively.

Table 2 Impacts of different variants on hospital usage

	Bed occupancy rate		
Variables	(1)	(2)	(3)
Alpha	-8.96* (4.8309)		
Delta		4.80* (4.9699)	
Omicron			4.16* (4.9836)
R-squared	0.231	0.186	0.181

Not\es: Standard errors in parentheses. ***, ** and *: p<0.01, p<0.05 and p<0.1 respectively.

Result 2

- Delta outbreak raises hospital mortality by 1.97%.
- Alpha and omicron outbreaks decrease hospital mortality by 0.28% and 0.17% respectively.

Table 3 Impacts of different variants on hospital performance

	In-hospital mortality rate		
Variables	(1)	(2)	(3)
Alpha	-0.28* (0.0126)		
Delta		1.97* (0.0122)	
Omicron			-0.17* (0.0123)
R-squared	0.485	0.517	0.509

Notes: Standard errors in parentheses. ***, ** and *: p<0.01, p<0.05 and p<0.1 respectively.

Discussions

1. The negative outcomes of alpha variant on bed occupancy and mortality indicate that alpha variant does not induce hospital overcrowding in the United Arab Emirates.
   Potential reason: the lockdown protection to the healthcare system
2. Delta outbreak causes a rise in bed occupancy and mortality.
   Potential reason: the removal of lockdown restrictions with a low vaccination coverage
3. Omicron outbreak brings more bed occupancy but declined mortality.
   Potential reason: an increased vaccination rate

Conclusion

Different SARS-CoV-2 variants impact differently on hospital usage and performance in the United Arab Emirates.