

THE EFFECT OF SOCIAL DISTANCING, ANTIVIRAL THERAPY, AND BOOSTER VACCINE ON MITIGATING OMICRON SPREAD: A MATHEMATICAL MODELING STUDY

Jongmin LEE¹, Renier MENDOZA^{1,2}, Victoria May P. MENDOZA^{1,2}, Youngsuk KO¹,
Jacob LEE³, Yubin SEO³ and Eunok JUNG¹

1) *Department of Mathematics, Konkuk University, Seoul 05029, KOREA*

2) *Institute of Mathematics, University of the Philippines Diliman, Quezon City 1101, PHILIPPINES*

3) *Division of Infectious Diseases, Department of Internal Medicine, Kangnam Sacred Heart Hospital, Seoul 07068, KOREA*

ABSTRACT

Since the Omicron variant emerged in December 2021, an unprecedented wave of COVID-19 happened in the Republic of Korea, even though about 80% of people were fully vaccinated. To investigate what happened during this period, we propose a mathematical model of COVID-19 considering Omicron and previous variants, booster vaccine, waning of immunity, breakthrough infection, and antiviral therapy. We quantify the effects of non-pharmaceutical intervention by estimating the reduction in transmission, $\mu \in [0, 1]$, induced by government policies from when vaccination started (Feb 26, 2021) until the testing policy is changed (Feb 3, 2022). Simulations show that in December 2021, the immunity of more than 20% vaccinated people waned. Thus, the rate of breakthrough infection increased significantly. Nevertheless, our results suggest that the incidence rate and the severity of the vaccinated group were substantially lower than the unvaccinated group. We present an approach to quantify the acceptable level of social distancing according to Omicron's transmissibility, severity, and vaccine immunity evasion. Furthermore, when we consider the antiviral therapy with 89% effectiveness against severity, a lower level of social distancing can be implemented without overburdening the healthcare system. Our research emphasizes the importance of pharmaceutical interventions, like vaccines and antiviral therapy, in easing social distancing protocols.

REFERENCES

1. Jongmin Lee, Renier Mendoza, Victoria May P. Mendoza, Youngsuk Ko, Jacob Lee, Yubin Seo, Eunok Jung, "Modelling The Effects of Social Distancing, Antiviral Therapy, And Booster Shots On Mitigating Omicron Spread", *Research Square*, 09 February 2022, *PREPRINT*.
2. Raphael Sonabend, Lilith K Whittles, Natsuko Imai, Pablo N Perez-Guzman, *et al.*, "on-pharmaceutical interventions, vaccination, and the SARS-CoV-2 delta variant in England: a mathematical modelling study", *The Lancet*, 2021, *398(10313):1825–1835*.