Modeling vaccination strategies with limited early COVID-19 vaccine access in low- and middle-income countries: A case study of Thailand

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Rationale and objective: The first year of COVID-19 vaccine availability historically saw a stark global disparity. While around 58% of the world's population received at least one vaccine dose by the end of 2021, over 70% of individuals in wealthy nations had received the primary vaccination regimen. In sharp contrast, a mere 4% of individuals in low-income countries received at least a single vaccine dose. In this study, we used Thailand as a case study to delve into the potential vaccination strategies to mitigate the disparities in early vaccine accessibility in low- and middle-income nations.

Summary: In this study, we utilized an agestructured modeling approach to examine the implications of various vaccination strategies, vaccine prioritization, and vaccine rollout speeds in Thailand. The model directly compares the effectiveness of several vaccination strategies, including the heterologous vaccination where CoronaVac (CV) vaccine was administered as the first dose, followed by ChAdOx1 nCoV-19 (AZ) vaccine as the second dose, under varying disease transmission dynamics. We found that the traditional AZ homologous vaccination was more effective than the CV homologous vaccination, regardless of disease transmission dynamics. However, combining CV and AZ vaccines via either parallel homologous or heterologous vaccinations was more effective than relying solely on AZ homologous vaccination. Additionally, prioritizing vaccination for the elderly aged 60 years and above was the most effective way to reduce mortality when community transmission is wellcontrolled. On the other hand, prioritizing workers aged 20-59 was most effective in lowering COVID-19 cases, irrespective of the transmission dynamics. These findings suggested that in low- and middle-income countries where early access to high-efficacy vaccines might be limited, obtaining any accessible vaccines as early as possible and using them in parallel with other higherefficacy vaccines might be a better strategy than waiting for and relying solely on higher-efficacy vaccines.

Outcome: Our findings indicated that employing parallel homologous or heterologous vaccination strategies with all available CV and AZ vaccines was more effective in controlling COVID-19 than relying solely on AZ vaccination. Moreover, faster vaccine rollout speeds were crucial in reducing COVID-19 infections and deaths across all vaccine prioritization strategies.

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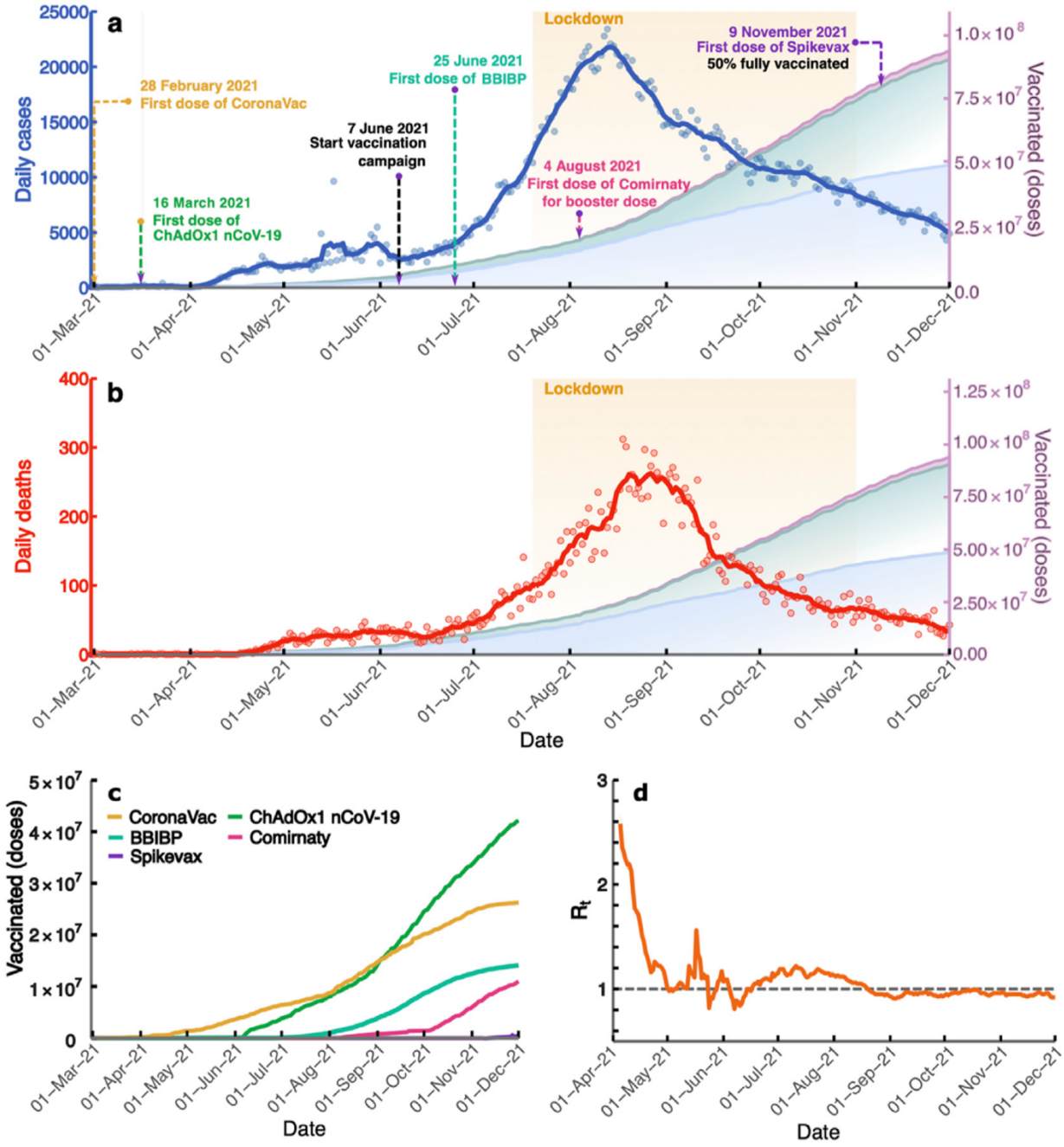
Related SDGs goal: 3. Good health and well-being.



Graphical summary: Vaccination and COVID-19 situations in Thailand. The blue line (a) and the red line (b) illustrate the number of daily new cases and the number of daily deaths, respectively. The blue, green, and purple areas show the cumulative numbers of first, second, and booster doses. The black-dashed arrows indicate the time point when the vaccination campaign started. The colored dashed arrows point to the start date of administering the vaccines from the different manufacturers. The yellow highlight area shows the duration of the lockdown measure. (c) Cumulative doses of vaccines from different manufacturers that have been delivered. (d) The time-varying reproduction numbers starting from April 1 to December 1, 2021. The line shows the median of R_t, and the shaded area indicates the 95% CI. The horizontal dashed line indicates the R t threshold value of 1.

Related publication:

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