



*Research article*

**Modeling the SARS-CoV-2 sublineages XBB and BQ.1 in Mexico, considering multiple vaccinations, booster dose, waning immunity and cross-immunity**

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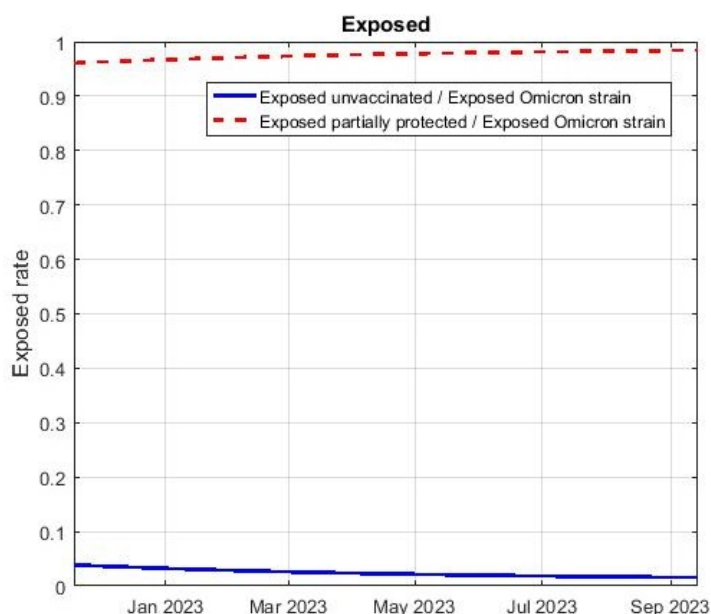
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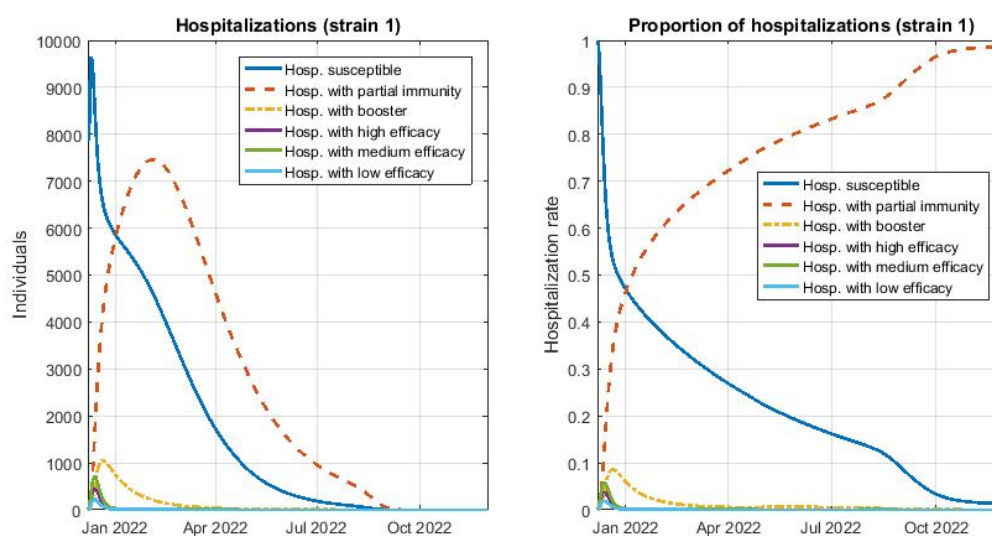
\* **Correspondence:** Email: [uapdl@hotmail.com](mailto:uapdl@hotmail.com).

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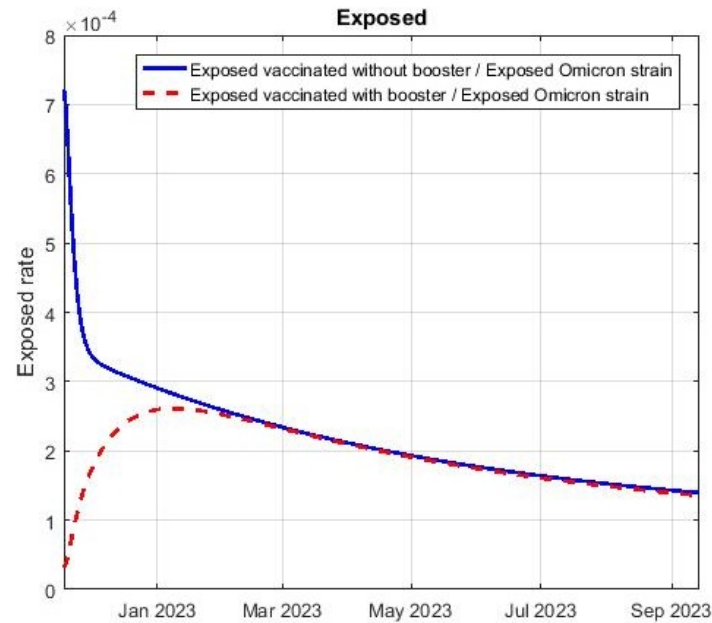
**Supplementary**



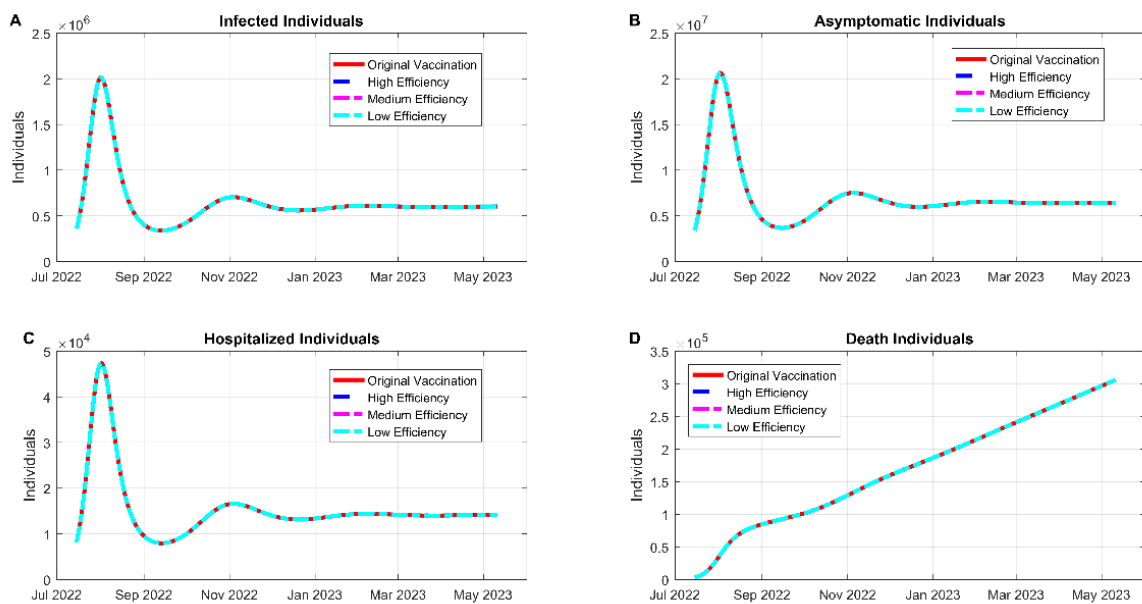
**Figure S1.** The ratio of exposed individuals based on their vaccination status. The blue solid line indicates that individuals are unvaccinated, while the red dotted line represents individuals that are partially protected.



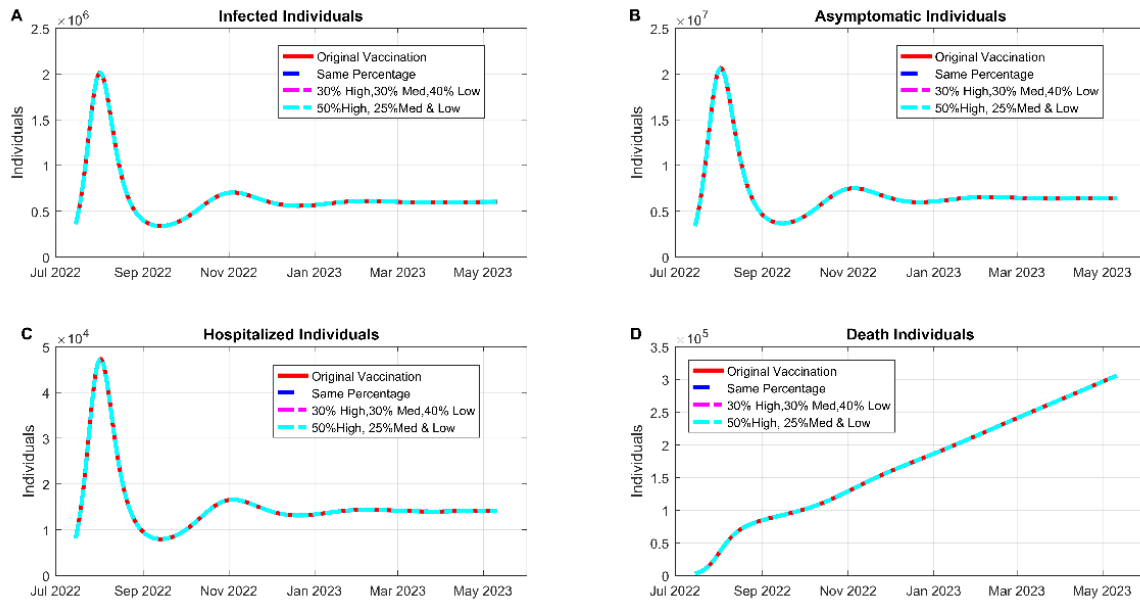
**Figure S2.** The hospitalization ratio for strain 1 (Omicron XBB) based on the three groups of vaccine efficiency applied in Mexico. The blue solid line indicates unvaccinated individuals; the orange dotted line represents individuals who are partially protected; the yellow solid line indicates individuals with a booster; the purple solid line denotes individuals with a high-efficiency vaccine and no boosters; the green solid line represents individuals with a medium-efficiency vaccine and no boosters, and the light blue solid line indicates individuals with a low-efficiency vaccine and no boosters. Left panel shows the number of hospitalized individuals in each subpopulation, right panel shows the proportion of each subpopulation with respect to the total hospitalizations for strain 1.



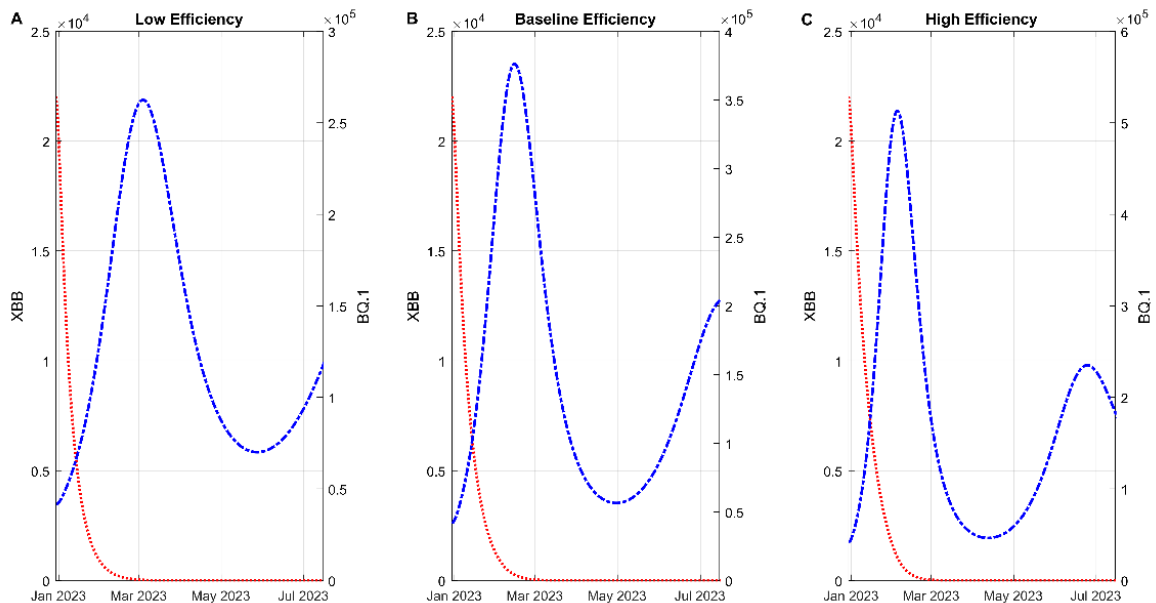
**Figure S3.** The exposed ratio based on whether the vaccinated individual has a booster or not. The blue solid line indicates individuals that have not received their booster, while the red dotted line are individuals that have received one or two booster doses.



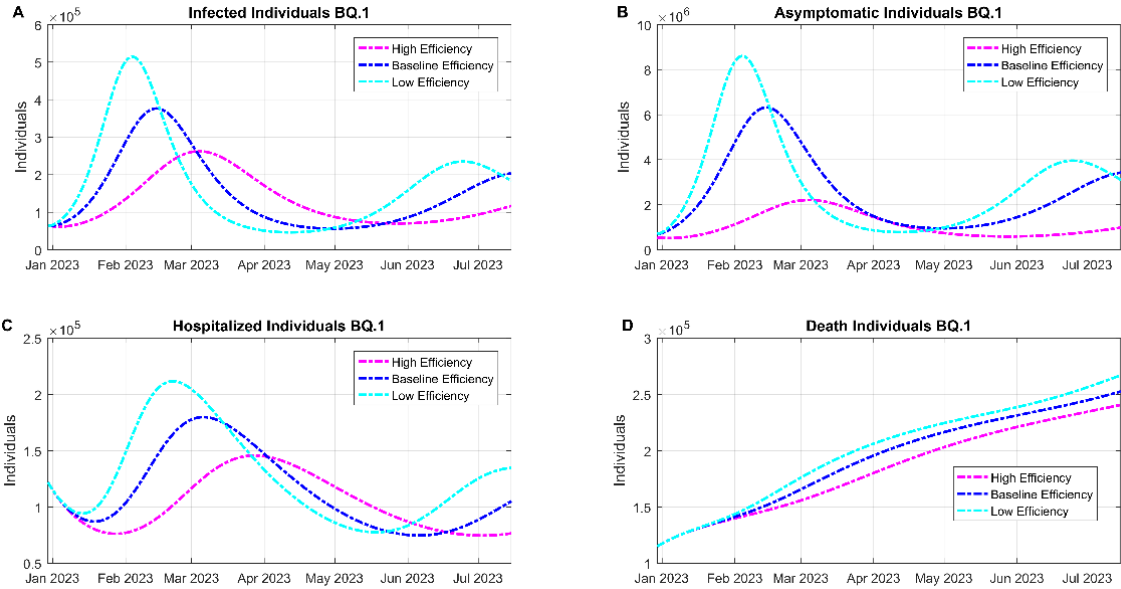
**Figure S4.** Vaccine efficiency in the primary application and boosters in Mexico varying the number of vaccines based on three efficiency groups. Dynamics for A: infected individuals, B: asymptomatic individuals, C: hospitalized, D: dead individuals from the BQ.1 Omicron variant. All four curves overlap since the difference is minimal.



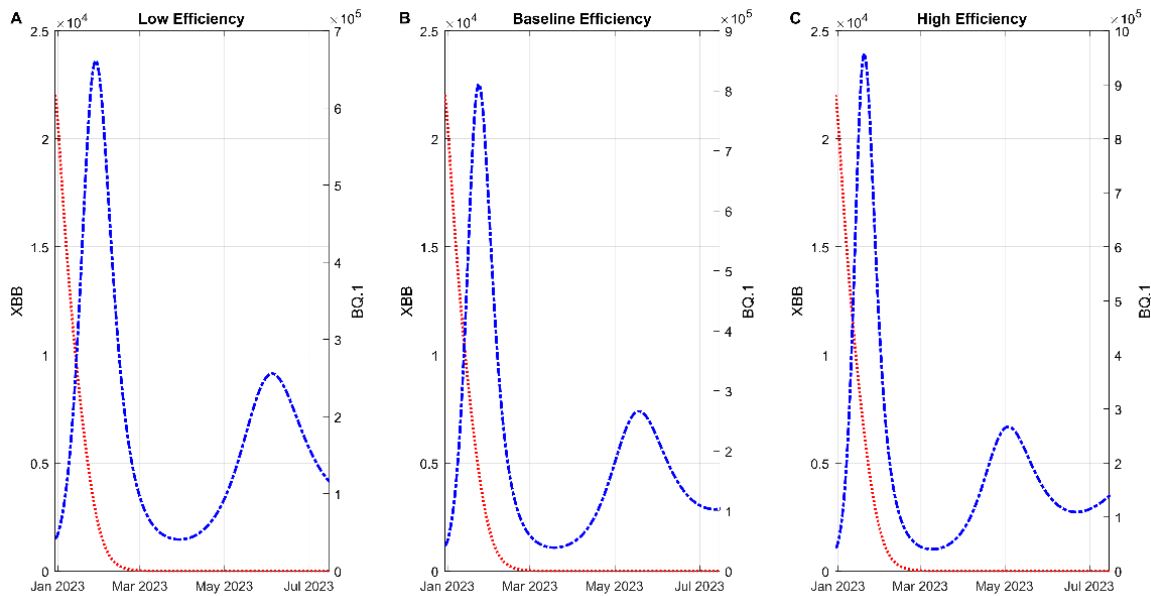
**Figure S5.** Vaccine efficiency in the primary application and boosters in Mexico. Dynamics for A: infected individuals, B: asymptomatic individuals, C: hospitalized, D: dead individuals from the BQ.1 Omicron variant. All four curves overlap since the difference is minimal.



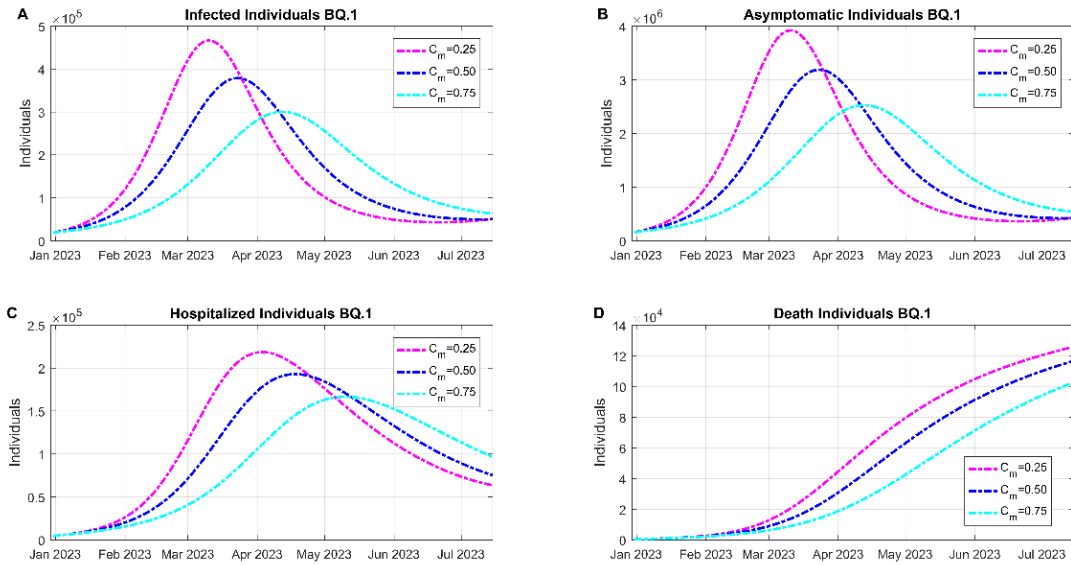
**Figure S6.** Simulation of different booster efficiency. A: Simulation of the dynamics of symptomatic individuals with low efficiency for the booster dose; B: Simulation of the dynamics of symptomatic individuals with a baseline efficiency for the booster dose; C: Simulation of the dynamics of symptomatic individuals with a high efficiency of the booster dose. In all graphs, the red dotted line indicates the dynamics of the XBB sublineage, while the blue dotted line denotes the dynamics of the BQ.1 sublineage.



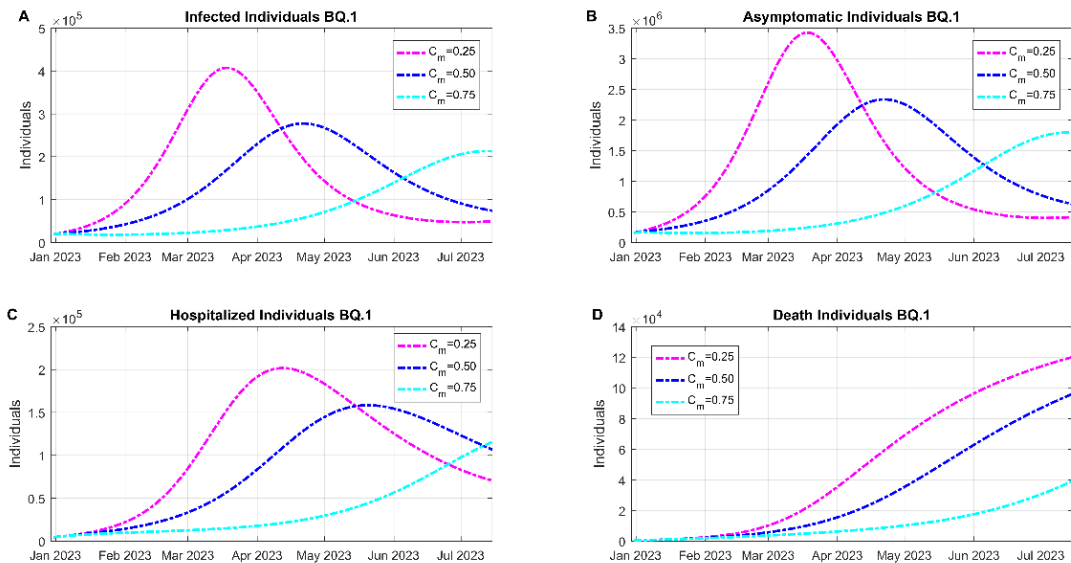
**Figure S7.** Simulation of the overall different booster efficiency. Dynamics for A: infected individuals, B: asymptomatic individuals, C: hospitalized, D: death toll individuals from the BQ.1 Omicron variant.



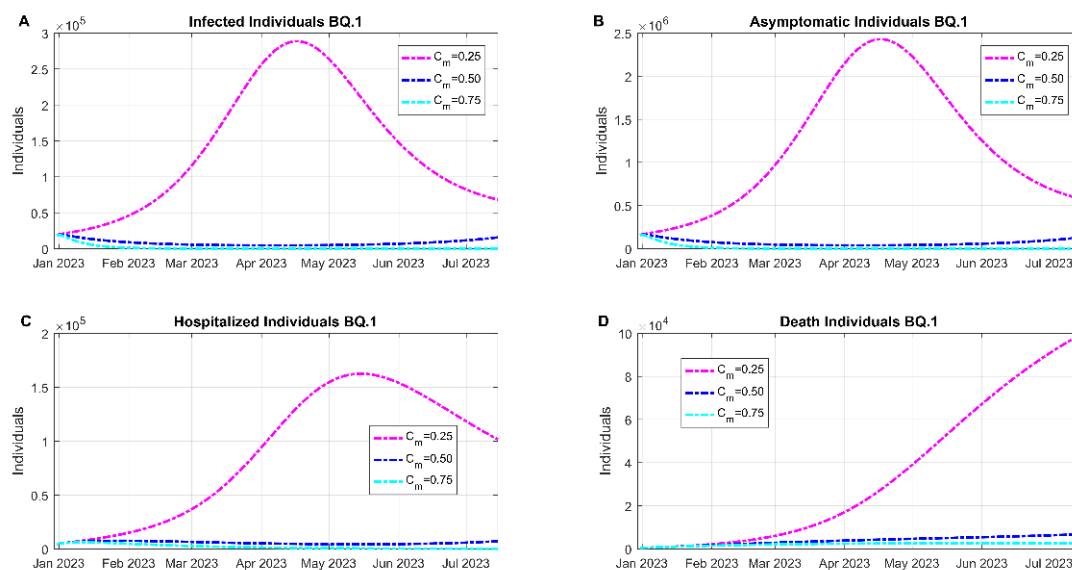
**Figure S8.** Simulation of different primary vaccine efficiency. A: Simulation of the dynamics of symptomatic individuals with low efficiency of the booster dose; B: Simulation of the dynamics of symptomatic individuals with a baseline efficiency of the booster dose; C: Simulation of the dynamics of symptomatic individuals with high efficiency of the booster dose. In all graphs, the red dotted line indicates the dynamics of the XBB sublineage, while the blue dotted line denotes the dynamics of the BQ.1 sublineage.



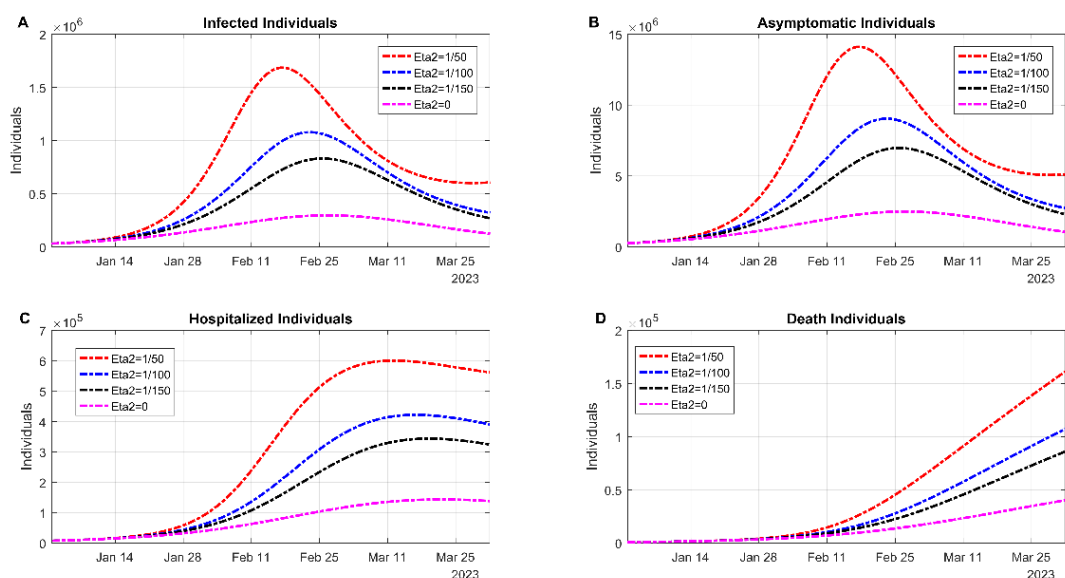
**Figure S9.** Evaluating the importance of the usage of face masks with a cloth face mask with 30% efficiency for the unvaccinated or vaccinated population. A: Dynamics of the infected symptomatic individuals; B: Asymptomatic infected individuals; C: Variation of hospital admission; D: Death toll of COVID-19. In all graphs, the pink dotted line represents that 25% uses face mask, the blue dotted line denotes that 50% uses face masks. Finally, the cyan dotted line indicates that 75% of the population wears a face mask.



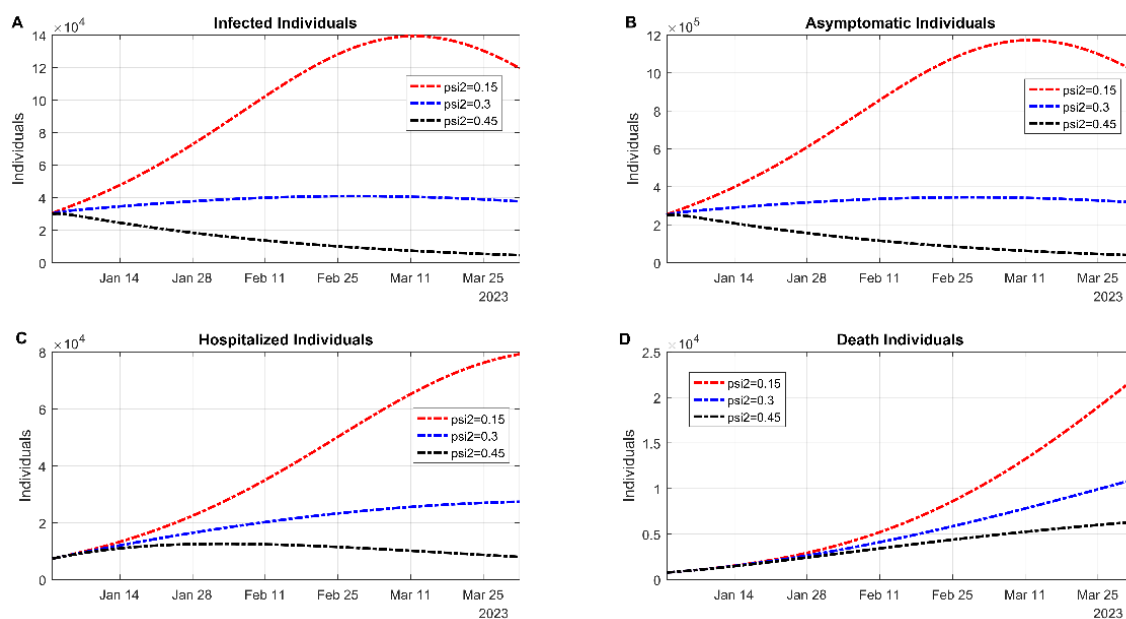
**Figure S10.** Evaluating the importance of the usage of face masks with an improved cloth face mask with 50% efficiency for the unvaccinated or vaccinated population. A: Dynamics of the infected symptomatic individuals; B: Asymptomatic infected individuals; C: Variation of hospital admission; D: Death toll of COVID-19. In all graphs, the pink dotted line represents that 25% uses face mask, the blue dotted line denotes that 50% uses face masks. Finally, the cyan dotted line indicates that 75% of the population wears a face mask.



**Figure S11.** Evaluating the importance of the usage of face masks with a N95 face mask with 95% efficiency for the unvaccinated or vaccinated population. A: Dynamics of the infected symptomatic individuals; B: Asymptomatic infected individuals; C: Variation of hospital admission; D: Death toll of COVID-19. In all graphs, the pink dotted line represents that 25% uses face mask, the blue dotted line denotes that 50% uses face masks. Finally, the cyan dotted line indicates that 75% of the population wears a face mask.



**Figure S12.** Dynamics of the population when the waning rate is varied between July and August 2022. A: Dynamics of the infected symptomatic individuals; B: Asymptomatic infected individuals; C: Variation of hospital admission; D: Death toll of COVID-19. In all panels, the red dotted line means that immunity wanes in 50 days, the blue dotted line in 100 days, the black dotted line in 150 days and finally the pink dotted lines denote a sterilizing immunity.



**Figure S13.** Dynamics of the population when the cross immunity is varied between July and August 2022. A: Dynamics of the infected symptomatic individuals; B: Asymptomatic infected individuals; C: Variation of hospital admission; D: Death toll of COVID-19. In all panels, the red dotted line means that, once infected, we only have a 15% of protection, the blue dotted indicates that we only have a 30% of protection, the black dotted line represents that we only have a 45% of protection.



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