Supplement to: "When do elementary students need masks in school? Model-estimated risk of in-school SARS-CoV-2 transmission and related infections among household members before and after student vaccination"

Methods

To generate Figures 1 and 2, we generated 150,000 paired samples of observed community incidence and mitigation effectiveness by using Latin hypercube sampling to draw from a Uniform distribution of both parameters with limits 0 to 60 cases/100k/day and 0 to 1, respectively (a range of only 0 to 50 cases/100k/day for the observed community incidence is presented in the figures to allow the smoothed heatmaps to reflect more accurately the raw model output). For each of the paired samples, we ran the model presented in Bilinski, Salomon, Giardina, Ciaranello, and Fitzpatrick (2021) using the model code available at https://github.com/abilinski/BackToSchool2/tree/master/3 - Scripts/Paper 3 for each of the 24 combinations of the following different scenarios: (1) baseline daily adult-to-adult secondary attack rates of 2% (reflecting the wild-type virus), 3.5% (alpha variant), and 7% (delta variant); (2) child vaccination coverage of 0% and 50%; (3) adult vaccination coverage of 50% and 70%; and (4) remote and in-school instruction. To calculate the in-school transmissions presented in Figure 1, we only analyzed the in-school instruction model runs. To calculate the average additional infections among the immediate school community during in-school instruction relative to remote, for each sample of observed community incidence and mitigation effectiveness we subtracted the total number of infections during remote instruction from the number of total infections during in-school instruction.

To generate the smoothed heatmaps presented in the letter, we fit a regression to the raw model output for each outcome and associated scenario (e.g., more than one in-school transmission in the wild-type, 0% child vaccine, 70% adult vaccine scenario) as a function of observed community incidence and mitigation effectiveness. We tested five potential specifications: linear, quadratic, cubic, and quartic polynomials, and linear regression with a log transformation on each predictor. For each scenario, we selected the regression which minimized the sum squared error in a hold-out test set containing 15,000 (10%) of the samples. The raw heatmaps are also presented in this supplement for reference.

Additional Figures

Alternate versions of main text figures with 50% adult vaccination coverage

Figure S1: Probability of at least one in-school transmission, 50% adult vaccination

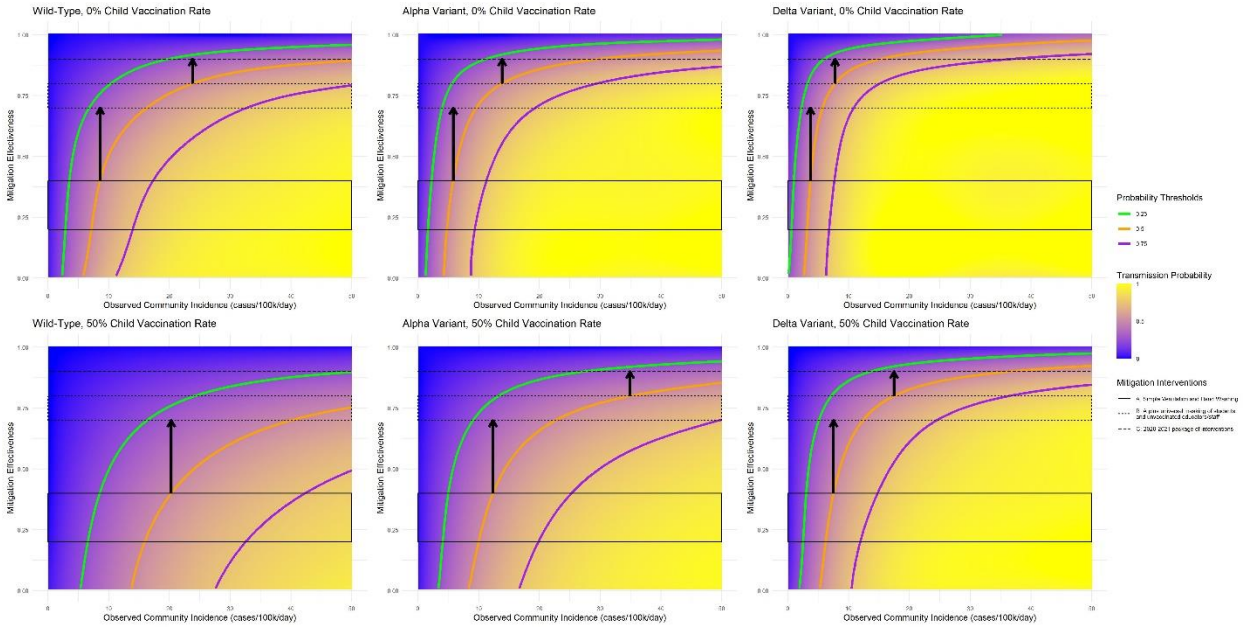
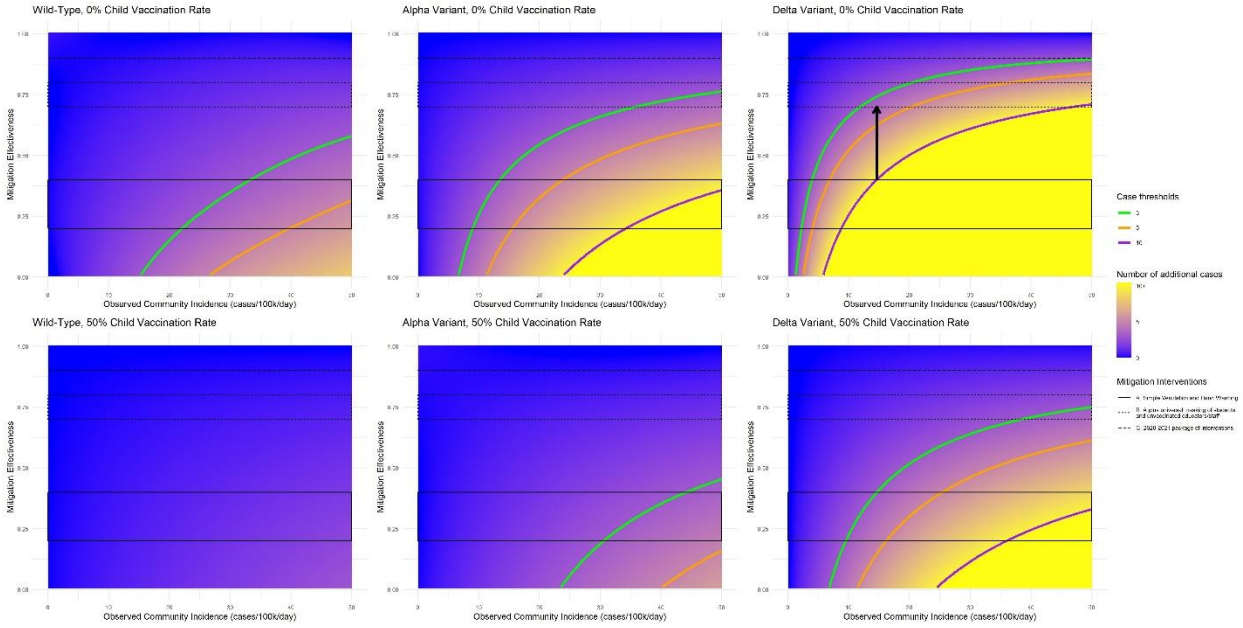


Figure S2: Average number of additional cases in immediate school community relative to remote instruction, 50% adult vaccination



Hospitalization Outcome (note that these figures present averages of model output across observed community incidence and mitigation effectiveness bins)

Figure S3: Average increase in hospitalizations among parents, teachers, staff, and adult family members per 100k, 70% adult vaccination

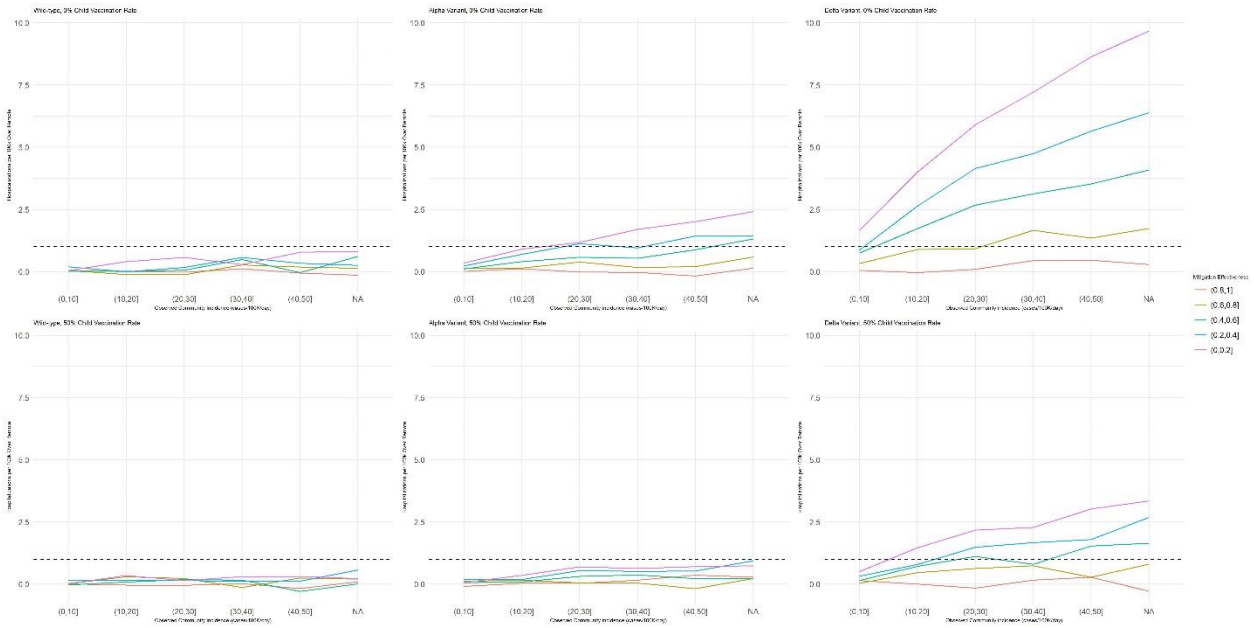
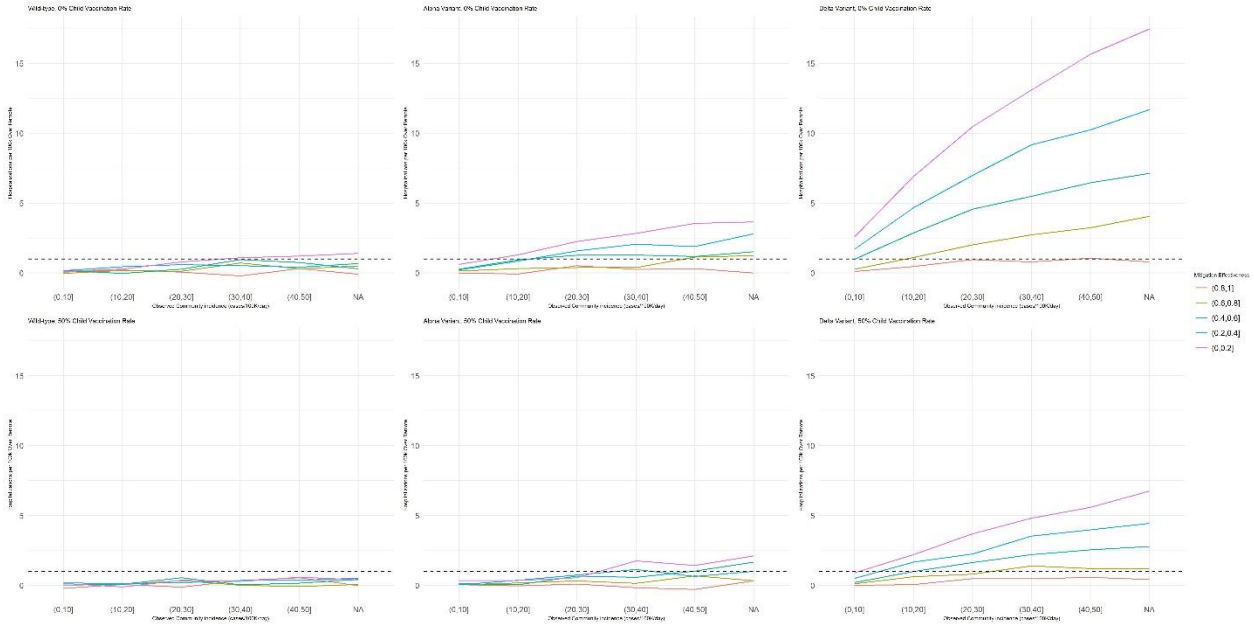


Figure S4: Average increase in hospitalizations among parents, teachers, staff, and adult family members per 100k, 50% adult vaccination



Raw Heatmaps

Figure S5: Probability of at least one in-school transmission, 70% adult vaccination

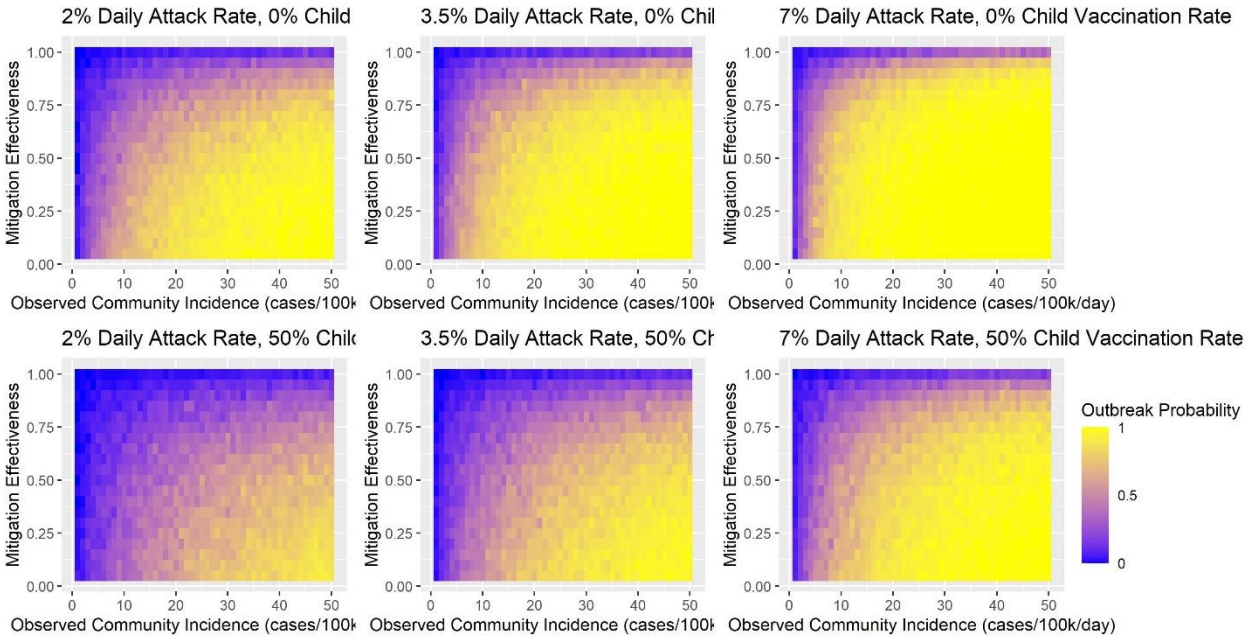


Figure S6: Probability of at least one in-school transmission, 50% adult vaccination

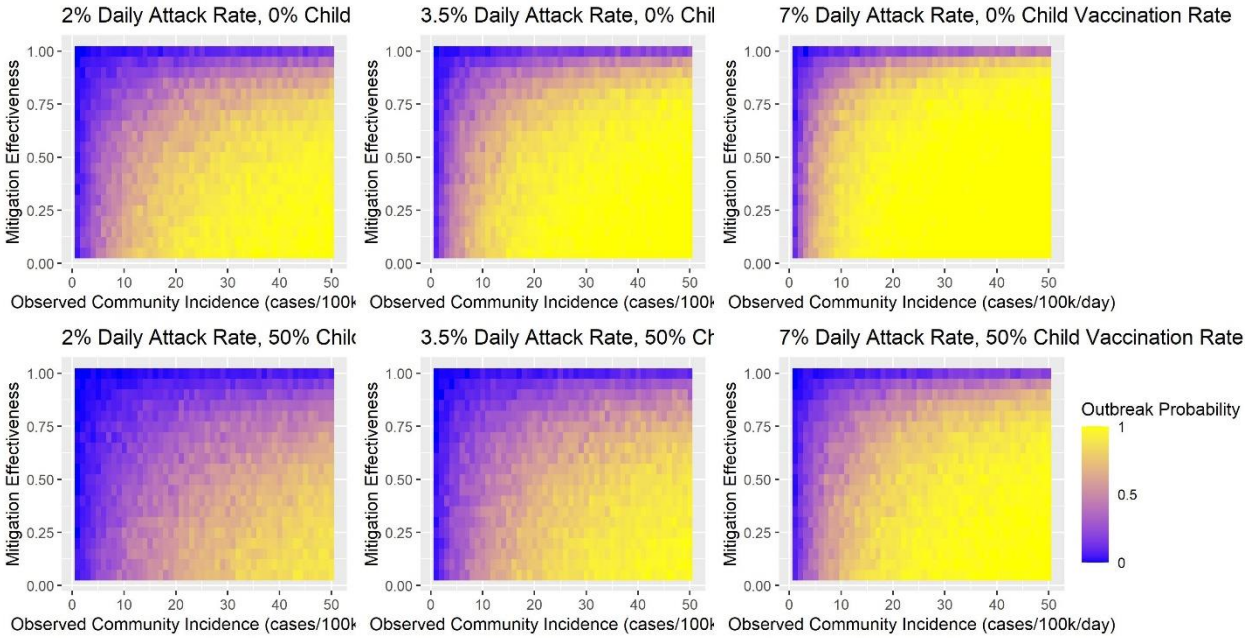


Figure S7: Average number of additional cases in immediate school community relative to remote instruction, 70% adult vaccination (gray areas represent regions with more than 10 or less than 0 cases, which were limits on the smoothed heatmap)

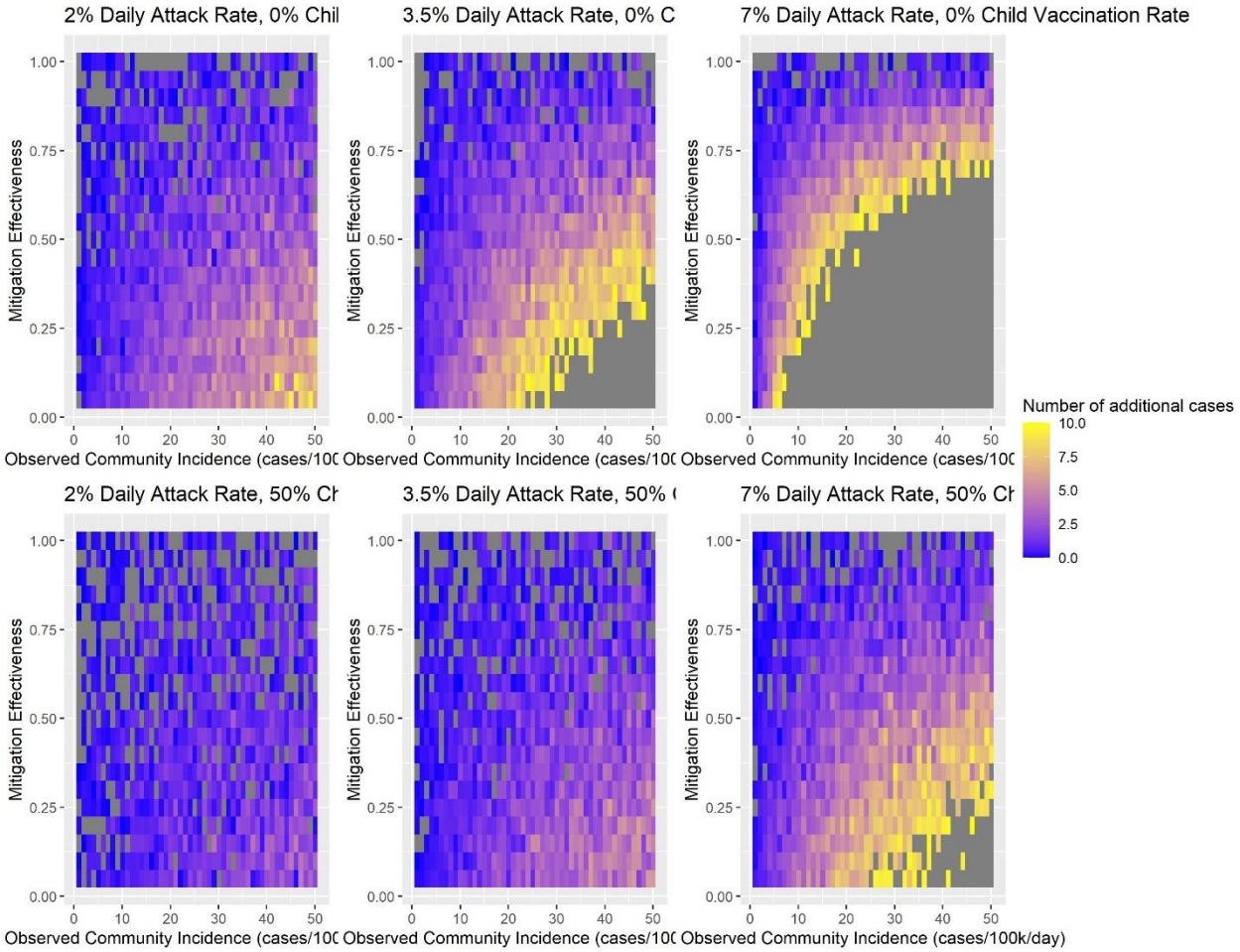
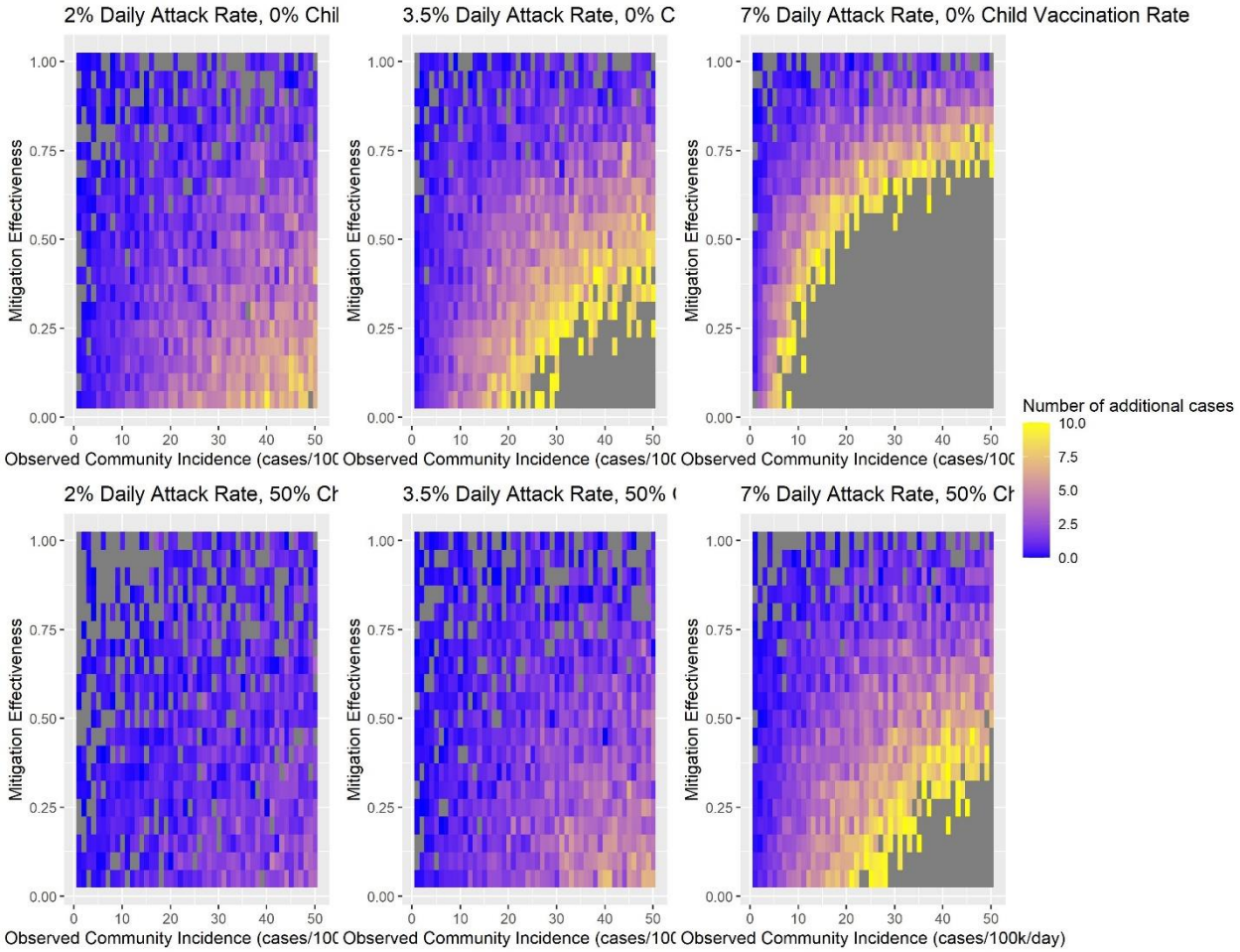


Figure S8: Average number of additional cases in immediate school community relative to remote instruction, 50% adult vaccination (gray areas represent regions with more than 10 or less than 0 cases, which were limits on the smoothed heatmap)



References

Bilinski, A., Salomon, J. A., Giardina, J., Ciaranello, A., & Fitzpatrick, M. C. (2021). Passing the Test: A Model-Based Analysis of Safe School-Reopening Strategies. *Ann Intern Med*. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/34097433. doi:10.7326/M21-0600