

BLUE CROSS AND BLUE SHIELD OF LOUISIANA'S COVID-19 OUTBREAK SIMULATION DETERMINISTIC SEIR MODELING

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BACKGROUND

Blue Cross and Blue Shield of Louisiana (BCBSLA) has been making effort to aggregate, analyze, and forecast COVID-19 projections for hospitalizations, deaths, and facility capacity. The analytics are routinely shared through an interactive Tableau dashboard internally and externally to assist in proper allocation of crucial medical resources and policymaking.

METHODS

- At the beginning of the COVID-19 pandemic, BCBSLA's analytics team developed an SEIR (Susceptible, Exposed, Infectious, Removed)-based model for the State of Louisiana.
- BCBSLA was able to create this model using demographic, clinical, and epidemiological inputs sourced from public health organizations, providers, and published literature.
- BCBSLA's SEIR model was implemented to assess the effect of different adjustments of the reproduction rate (R_t ranging from 0.2 to 25) across regions and over time.
- The model continues to be used to evaluate counterfactual scenarios (simulate hospital utilization with different preventive restrictions) and anticipate future utilization.

RESULTS

- The modeling predicted peak periods when Louisiana would be stressed in providing hospital beds to COVID-19 patients, which allowed decision-makers to make restriction policies in time and redistribute resources effectively.
- Additionally, vaccination and reinfection factors ($\omega=0.2$) were integrated into the prediction modeling in mid-2021 to adjust the models based on newer variants.
- The omicron surge was projected in early December 2021, when there was only an early sign of rebounding. The prediction was made one month ahead of the peak with high accuracy.
- The projection was shared internally and externally, to assist decision making of company strategy as well as policymaking.

Figure 1. BCBSLA COVID-19 SEIR Model

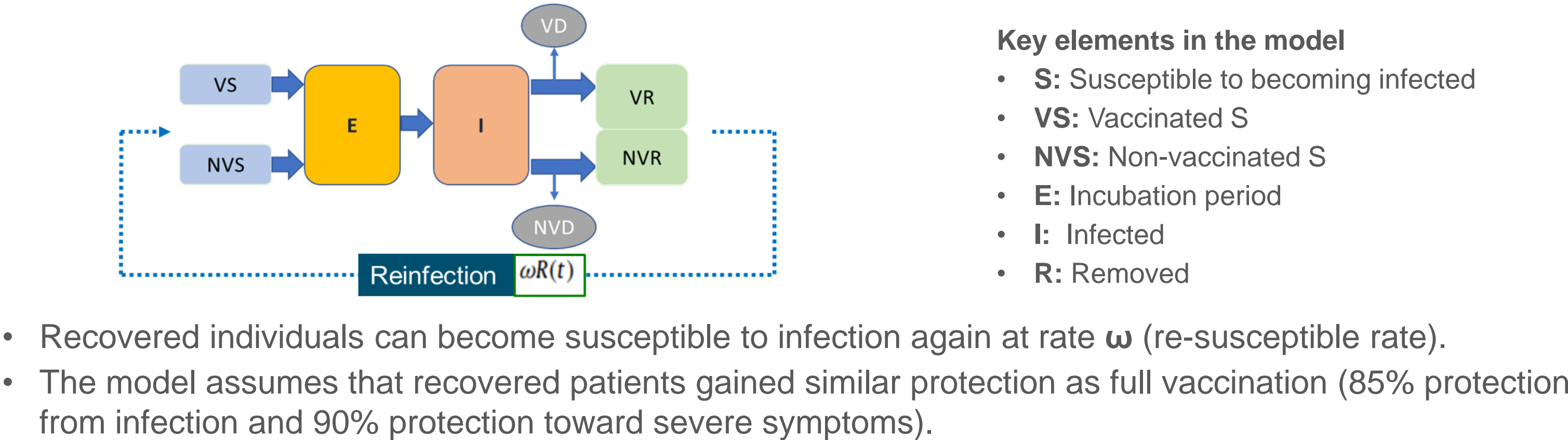
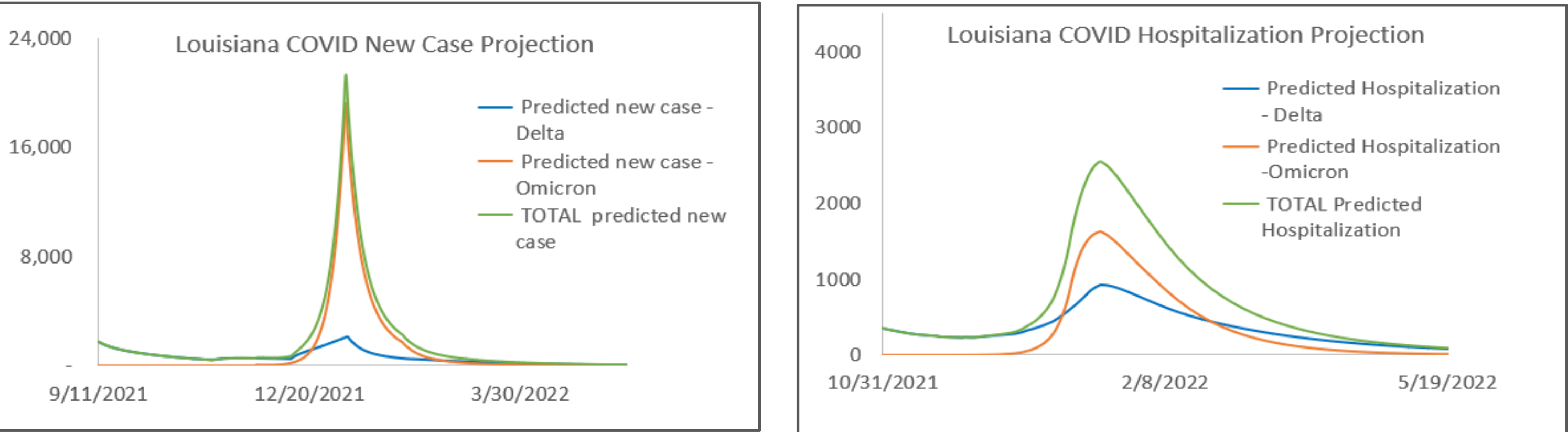


Figure 2. Louisiana Omicron Surge Projection



The projection of the omicron surge was made in early December, based on available data from other countries and states. The projection made the following assumptions about the omicron variant:

- The protection of the immunity from vaccination or previous infection had a 30% discount.
- The hospitalization rate had an 80% discount.
- The reproduction number of the omicron variant was about 3-4 times of the delta variant.

Figure 3. Louisiana Overall COVID-19 Cases Projection

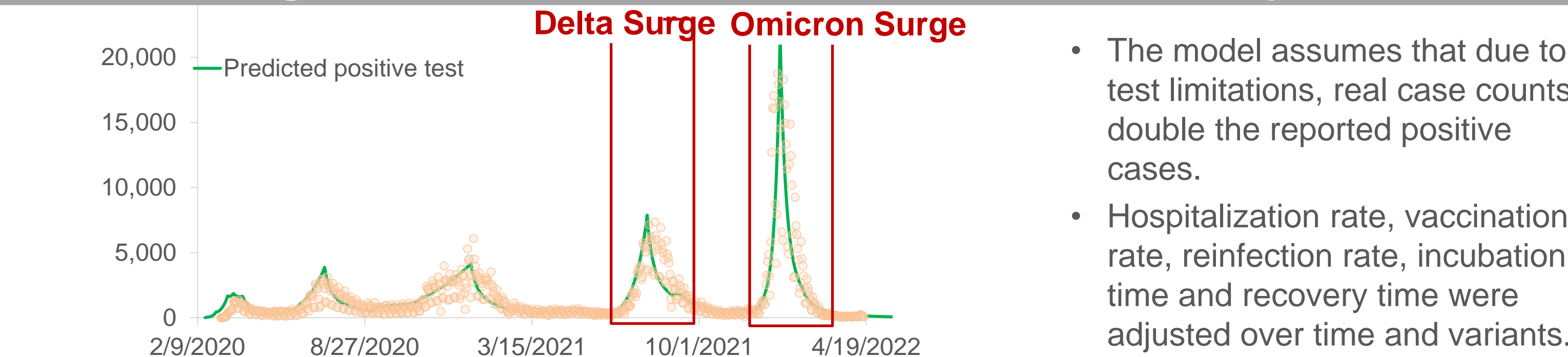


Figure 4. Louisiana COVID Hospitalization Projection

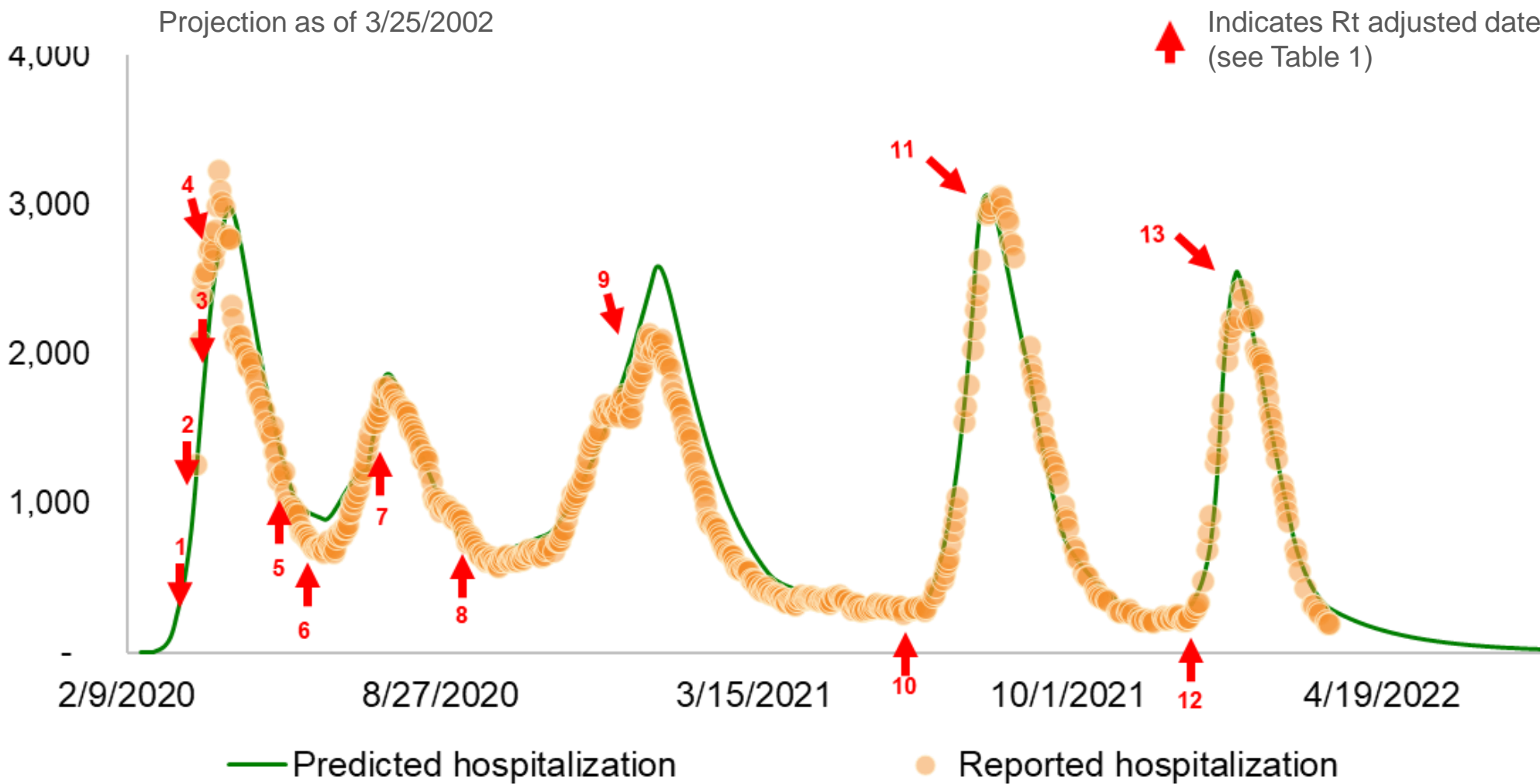


Table 1. Historical Reproduction Numbers and Impact of Policy on the Reproduction Numbers

Rt changing Point	Impact of Interventions on Rt	Rt value	Impact
1	Mardi Gras week ends 03/02/2020	5.9	
2	Schools close 03/16/2020	3.2	-45%
3	"Stay at home" order 03/22/2020	1.5	-53%
4	Mask mandates 04/03/2020	0.4	-76%
5	Reopening (phase 1) 05/15/2020	1.4	
6	Reopening (phase 2) 06/05/2020	2.5	
7	Mask mandate and bar closures 07/13/2020	0.5	-82%
8	Reopening (phase 3) 09/11/2020	1.4	
9	Holiday season ends 01/03/2021	0.5	-65%
10	Delta surge 06/15/2021	7.7	
11	Mask mandates 07/28/2021	1.0	-87%
12	Omicron variant 12/01/2021	25.0	
13	Holiday season ends 01/03/2022	0.5	-99%

CONCLUSIONS

- BCBSLA has proven to be a strong partner in the community during this COVID-19 crisis.
 - This is a successful example of data-driven models helping inform policy decisions for managing the COVID-19 outbreak.
 - "We are proud that at such a critical time for the state, our team was able to support the COVID-19 response through our analytics and data capabilities and technology."
- BCBSLA Chief Analytics and Data Officer
Somesh Nigam, Ph.D.

