Equity Allocation Outcomes Avoided Results

Chris Hoover et al

2022-12-08

## Process/clean bootstrapped samples and other input data

## Results text

For all three outcomes considered, the candidate model with the best out of sample performance contained an intervention-county interaction term, cumulative case rate, cumulative vaccinated rate, and the percent of the population aged 50 and older (Supplementary Table X). The best model for deaths also included a term for the weekly testing rate, though this model performed only marginally better than one without testing (Supplementary Table X).

From these models, it was estimated that in the six months following the vaccine equity allocation, 99525 (95%CI: 72111 - 129162) cases, 6678 (95%CI: 4429 - 9163) hospitalizations, and 546 (95%CI: 161 - 957) deaths were averted in VEM Q1 zip codes. Most of the outcomes averted in this time period came after July 1, 2021 in the beginning of California’s Delta variant wave (Fig 1). However, 18635 (95%CI: 13562 - 24101) cases, 1214 (95%CI: 809 - 1671) hospitalizations, and 97 (95%CI: 33 - 166) deaths were averted even in the first two months following the equity allocation.

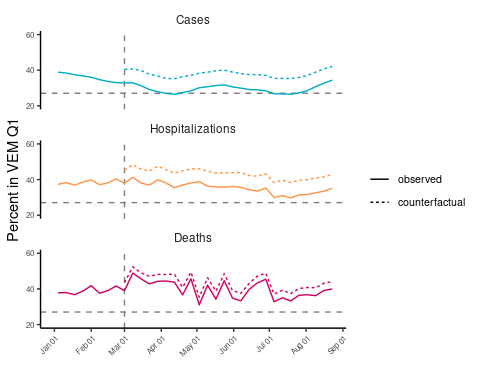
While 27% of California’s population resides in VEM Q1 areas, residents in VEM Q1 accounted for 36% of cases, 38% of hospitalizations, and 39% of mortalities in the two months before the policy (Fig 2). From the counterfactual analysis in the absence of the policy, this discrepancy is estimated to persist or increase (Fig 2, dashed lines). However, because of the outcomes averted due to the policy, excess COVID-19 cases and–to a lesser extent–hospitalizations in VEM Q1 were reduced (Fig 2, solid lines). Briefly in April and again in July, the number of cases in VEM Q1 reached levels proportionate to the VEM Q1 population ratio, suggesting a lack of excess risk in VEM Q1 (Fig 2). In the absence of the policy, counterfactual estimates suggest that this level would not have been reached.

There was variability in estimated outcomes avoided at the county level. Normalizing by population size, the best performing counties averted 690.75 (95%CI:-141.49 - 2345.59) cases/100,000, 83.49 (95%CI:35.57 - 154.18) hospitalizations/100,000, and 8.34 (95%CI:0.25 - 21.89) deaths/100,000, while the worst performing counties averted -5180.88 (95%CI:-16505.83 - 15.93) cases/100,000, -136.42 (95%CI:-583.6 - 20.08) hospitalizations/100,000, and -69.03 (95%CI:-235.48 - 3.42) deaths/100,000. Negative outcomes averted result from more outcomes estimated in the counterfactual scenarios than were observed, implying the policy had a negative impact in these counties. However, this occurred most commonly in counties with smaller populations. Among counties with a population larger than 100,000 (representing 97.6% of the State’s population), the net rates were 317.55 (95%CI: 235.38 - 407.95) cases/100,000 averted, 20.88 (95%CI: 14.08 - 28.51) hospitalizations/100,000 averted, and 1.87 (95%CI: 0.71 - 3.12) deaths/100,000 averted.

## Figures

### Cumulative avoided and county results

### VEM Quartile ratio figures



### Counterfactual time series and cumulative avoided base plot

## png   
## 2

[Outcomes averted summary figure](../plots/baseplot_outcomes_averted.png)

## Octiles Sensitivity Analysis

## [1] "Contra Costa" "Inyo" "Lake" "Lassen" "Madera"   
## [6] "Mariposa" "Sierra" "Solano" "Trinity" "Yuba"

Restricting the counterfactual estimation procedure to VEM octiles 2 and 3 led to attenuated and highly uncertain estimates of the number of outcomes avoided. In this sensitivity analysis, -8659 (95%CI: -23099 - 6568) cases, -354 (95%CI: -1545 - 927) hospitalizations, and -199 (95%CI: -421 - 41) deaths were estimated to have been averted in VEM octile 2 zip codes. However, it should also be noted that model performance in this subset of zip codes was poor relative to the full dataset. Furthermore, ten counties were excluded from this sensitivity analysis altogether since they lacked zip codes that fall into both VEM octile 2 and 3.

## Model performance table

| Model Terms | Cases MSE (range) | Hospitalizations MSE (range) | Deaths MSE (range) |
| --- | --- | --- | --- |
| BASE | 761 (757 - 764) | 4.7 (4.7 - 4.8) | 0.764 (0.762 - 0.766) |
| BASE+int:spline | 759 (755 - 762) | 4.7 (4.6 - 4.8) | 0.764 (0.762 - 0.766) |
| BASE+int:county | 706 (702 - 712) | 4.4 (4.4 - 4.5) | 0.73 (0.728 - 0.733) |
| BASE+cumcasep100k | 593 (588 - 603) | 4.6 (4.5 - 4.6) | 0.749 (0.747 - 0.751) |
| BASE+cumvaxp100k | 758 (754 - 761) | 4.5 (4.5 - 4.6) | 0.757 (0.755 - 0.759) |
| BASE+testp100k | 1736 (1134 - 3099) | 4.7 (4.7 - 4.8) | 0.762 (0.761 - 0.764) |
| BASE+per50up | 732 (728 - 736) | 4.7 (4.7 - 4.8) | 0.759 (0.757 - 0.761) |
| BASE+int:county+testp100k | 3696 (2055 - 7002) | 4.4 (4.4 - 4.5) | 0.727 (0.724 - 0.73) |
| BASE+int:county+cumcasep100k+cumvaxp100k | 525 (519 - 536) | 4.2 (4.1 - 4.2) | 0.713 (0.71 - 0.717) |
| BASE+int:county+per50up | 677 (672 - 681) | 4.4 (4.4 - 4.5) | 0.725 (0.723 - 0.727) |
| BASE+int:county+cumcasep100k+cumvaxp100k+testp100k | 1239 (802 - 1800) | 4.2 (4.1 - 4.2) | 0.712 (0.709 - 0.716) |
| BASE+int:county+cumcasep100k+cumvaxp100k+per50up | 522 (516 - 532) | 4.1 (4 - 4.1) | 0.697 (0.694 - 0.7) |
| BASE+int:county+cumcasep100k+cumvaxp100k+testp100k+per50up | 968 (678 - 1373) | 4.1 (4 - 4.1) | 0.696 (0.693 - 0.703) |
| BASE+int:spline+testp100k | 1258 (914 - 2014) | 4.7 (4.6 - 4.8) | 0.762 (0.761 - 0.764) |
| BASE+int:spline+cumcasep100k+cumvaxp100k | 591 (586 - 601) | 4.4 (4.3 - 4.5) | 0.743 (0.741 - 0.745) |
| BASE+int:spline+per50up | 730 (726 - 734) | 4.7 (4.6 - 4.8) | 0.759 (0.757 - 0.761) |
| BASE+int:spline+cumcasep100k+cumvaxp100k+testp100k | 710 (620 - 856) | 4.4 (4.3 - 4.5) | 0.742 (0.741 - 0.744) |
| BASE+int:spline+cumcasep100k+cumvaxp100k+per50up | 588 (583 - 598) | 4.3 (4.2 - 4.4) | 0.725 (0.723 - 0.728) |
| BASE+int:spline+cumcasep100k+cumvaxp100k+testp100k+per50up | 667 (602 - 784) | 4.3 (4.2 - 4.4) | 0.724 (0.722 - 0.727) |

## Scratch

