

COVID-19 Baseline Risk Score Analysis Report

MockCOVE Study

USG COVID-19 Response Biostatistics Team

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Chapter 1

Disclaimers

- The data presented in the analysis originated from the Moderna Sponsored mRNA-1273-P301 clinical study and are provided to NIAID in accordance with Clinical Trial Agreement between the parties. The study was funded in part by BARDA under Government Contract No. 75A50120C00034
- The preliminary immunogenicity data presented here do not reflect the Sponsors statistical analysis plan and therefore should not be interpreted as a protocol defined read-out of the clinical study.
- These data are not to be disclosed without written permission of Moderna.

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Chapter 2

Baseline Risk Score (Proxy for SARS-CoV-2 Exposure)

Table 2.1: Variables considered for risk score analysis.

| Variable.Name | Definition | Total.missing.values | Comments |
|----------------------|--|----------------------|----------|
| MinorityInd | Baseline covariate underrepresented minority status (1=minority, 0=non-minority) | 0/13336 (0.0%) | NA |
| EthnicityHispanic | Indicator ethnicity = Hispanic (0 = Non-Hispanic) | 0/13336 (0.0%) | NA |
| EthnicityNotreported | Indicator ethnicity = Not reported (0 = Non-Hispanic) | 0/13336 (0.0%) | NA |
| EthnicityUnknown | Indicator ethnicity = Unknown (0 = Non-Hispanic) | 0/13336 (0.0%) | NA |
| Black | Indicator race = Black (0 = White) | 0/13336 (0.0%) | NA |
| Asian | Indicator race = Asian (0 = White) | 0/13336 (0.0%) | NA |
| NatAmer | Indicator race = American Indian or Alaska Native (0 = White) | 0/13336 (0.0%) | NA |
| PacIsl | Indicator race = Native Hawaiian or Other Pacific Islander (0 = White) | 0/13336 (0.0%) | NA |
| Multiracial | Indicator race = Multiracial (0 = White) | 0/13336 (0.0%) | NA |
| Other | Indicator race = Other (0 = White) | 0/13336 (0.0%) | NA |
| Notreported | Indicator race = Not reported (0 = White) | 0/13336 (0.0%) | NA |
| Unknown | Indicator race = unknown (0 = White) | 0/13336 (0.0%) | NA |
| HighRiskInd | Baseline covariate high risk pre-existing condition (1=yes, 0=no) | 0/13336 (0.0%) | NA |
| Sex | Sex assigned at birth (1=female, 0=male) | 0/13336 (0.0%) | NA |
| Age | Age at enrollment in years, between 18 and 85 | 0/13336 (0.0%) | NA |
| BMI | BMI at enrollment (kg/m ²) | 0/13336 (0.0%) | NA |

Table 2.2: All learner-screen combinations (14 in total) used as input to the Superlearner.

| Learner | Screen* |
|---------|---|
| SL.mean | all |
| SL.glm | all glmnet univar_logistic_pval highcor_random |

Note:

*Screen details:

all: includes all variables

glmnet: includes variables with non-zero coefficients in the standard implementation of SL.glmnet that optimizes the lasso tuning parameter via cross-validation

univar_logistic_pval: Wald test 2-sided p-value in a logistic regression model < 0.10

highcor_random: if pairs of quantitative variables with Spearman rank correlation > 0.90 , select one of the variables at random

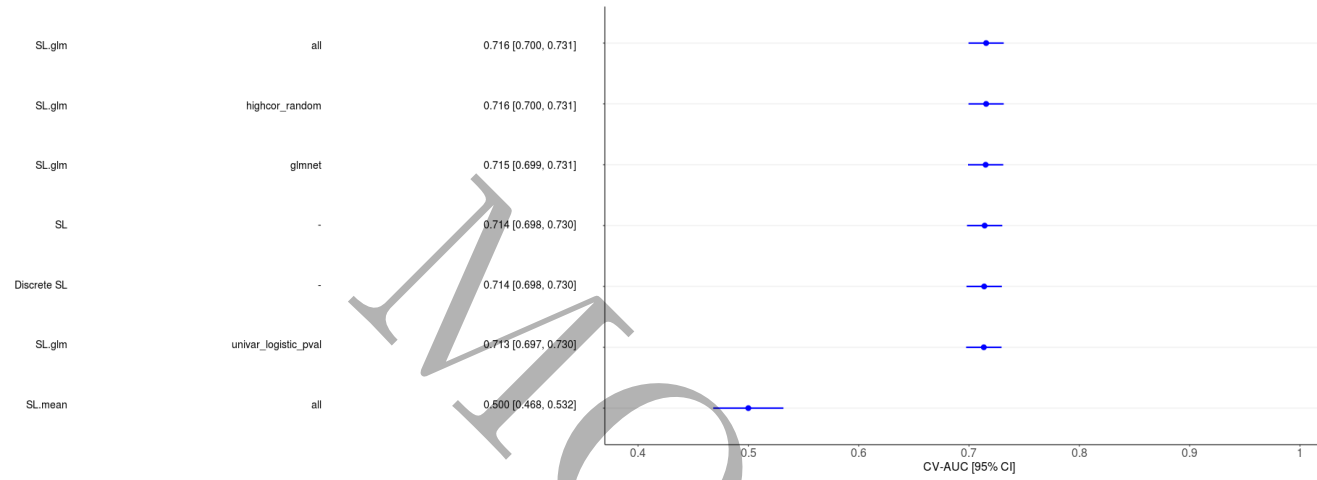


Figure 2.1: Cross-validated AUC (95% CI) of algorithms for predicting COVID-19 disease status starting 7 days after Day 57.



Figure 2.2: CV-estimated predicted probabilities of COVID-19 disease 7 days after Day 57 by case/control status for top 2 learners, SuperLearner and Discrete SL.



Figure 2.3: ROC curves based off CV-estimated predicted probabilities for the top 2 learners, Superlearner and Discrete SL.

Table 2.3: Weights assigned by Superlearner.

| Learner | Screen | Weight |
|----------------|---------------------------------|---------------|
| SL.glm | screen_all | 0.590 |
| SL.glm | screen_glmnet | 0.376 |
| SL.mean | screen_all | 0.034 |
| SL.glm | screen_univariate_logistic_pval | 0.000 |
| SL.glm | screen_highcor_random | 0.000 |

Table 2.4: Predictors in learners assigned weight > 0.0 by Superlearner.

| Learner | Screen | Weight | Predictors | Coefficient | Odds.Ratio |
|---------|---------------|--------|----------------------|-------------|------------|
| SL.glm | screen_all | 0.59 | (Intercept) | -2.767 | 0.063 |
| SL.glm | screen_all | 0.59 | MinorityInd | -0.015 | 0.985 |
| SL.glm | screen_all | 0.59 | EthnicityHispanic | -0.013 | 0.987 |
| SL.glm | screen_all | 0.59 | EthnicityNotreported | 0.046 | 1.048 |
| SL.glm | screen_all | 0.59 | EthnicityUnknown | -0.072 | 0.931 |
| SL.glm | screen_all | 0.59 | Black | -0.024 | 0.977 |
| SL.glm | screen_all | 0.59 | Asian | 0.057 | 1.058 |
| SL.glm | screen_all | 0.59 | NatAmer | 0.007 | 1.007 |
| SL.glm | screen_all | 0.59 | PacIsl | -0.025 | 0.975 |
| SL.glm | screen_all | 0.59 | Multiracial | -0.052 | 0.95 |
| SL.glm | screen_all | 0.59 | Other | 0.055 | 1.056 |
| SL.glm | screen_all | 0.59 | Notreported | 0.005 | 1.005 |
| SL.glm | screen_all | 0.59 | Unknown | 0.01 | 1.01 |
| SL.glm | screen_all | 0.59 | HighRiskInd | -0.019 | 0.981 |
| SL.glm | screen_all | 0.59 | Sex | -0.006 | 0.994 |
| SL.glm | screen_all | 0.59 | Age | 0.824 | 2.279 |
| SL.glm | screen_all | 0.59 | BMI | -0.045 | 0.956 |
| SL.glm | screen_glmnet | 0.376 | (Intercept) | -2.767 | 0.063 |
| SL.glm | screen_glmnet | 0.376 | EthnicityNotreported | 0.048 | 1.049 |
| SL.glm | screen_glmnet | 0.376 | EthnicityUnknown | -0.071 | 0.932 |
| SL.glm | screen_glmnet | 0.376 | Black | -0.035 | 0.966 |
| SL.glm | screen_glmnet | 0.376 | Asian | 0.05 | 1.051 |
| SL.glm | screen_glmnet | 0.376 | Multiracial | -0.064 | 0.938 |
| SL.glm | screen_glmnet | 0.376 | Other | 0.048 | 1.049 |
| SL.glm | screen_glmnet | 0.376 | Age | 0.824 | 2.279 |
| SL.glm | screen_glmnet | 0.376 | BMI | -0.045 | 0.956 |
| SL.glm | screen_glmnet | 0.376 | (Intercept) | -2.767 | 0.063 |
| SL.glm | screen_glmnet | 0.376 | EthnicityNotreported | 0.048 | 1.049 |
| SL.glm | screen_glmnet | 0.376 | EthnicityUnknown | -0.071 | 0.932 |
| SL.glm | screen_glmnet | 0.376 | Black | -0.035 | 0.966 |
| SL.glm | screen_glmnet | 0.376 | Asian | 0.05 | 1.051 |
| SL.glm | screen_glmnet | 0.376 | Multiracial | -0.064 | 0.938 |
| SL.glm | screen_glmnet | 0.376 | Other | 0.048 | 1.049 |
| SL.glm | screen_glmnet | 0.376 | Age | 0.824 | 2.279 |
| SL.glm | screen_glmnet | 0.376 | BMI | -0.045 | 0.956 |



Figure 2.4: Superlearner predicted probabilities of COVID-19 disease in vaccinees 7 days after Day 57 by case/control status.



Figure 2.5: ROC curve based off Superlearner predicted probabilities in vaccinees.

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Chapter 3

Appendix

- This report was built from the [CoVPN/correlates_reporting](https://github.com/CoVPN/correlates_reporting) repository with commit hash `e5dbe8146588ee375dd71dcdd7faeb53d0bcb9d`. A diff of the changes introduced by that commit may be viewed at https://github.com/CoVPN/correlates_reporting/commit/e5dbe8146588ee375dd71dcdd7faeb53d0bcb9d
- The sha256 hash sum of the raw input file, “COVID_VEtrial_practicedata_primarystage1.csv”:
`83d0f55d1745ffd42be124d8f9ec9a9903abcc13cd22f95e537542a08b41300a`
- The sha256 hash sum of the processed file, “moderna_mock_data_processed.csv”:
`28964ce20cfd70a621aff9df412c42b1178d5e749e0f49ddd79fbff2dc7c90a`