

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) | 0/30000 (0.0%) | NA |
| EthnicityHispanic | Indicator ethnicity = Hispanic (0 = Non-Hispanic) | 0/30000 (0.0%) | NA |
| EthnicityNotreported | Indicator ethnicity = Not reported (0 = Non-Hispanic) | 0/30000 (0.0%) | NA |
| EthnicityUnknown | Indicator ethnicity = Unknown (0 = Non-Hispanic) | 0/30000 (0.0%) | NA |
| Black | Indicator race = Black (0 = White) | 0/30000 (0.0%) | NA |
| Asian | Indicator race = Asian (0 = White) | 0/30000 (0.0%) | NA |
| NatAmer | Indicator race = American Indian or Alaska Native (0 = White) | 0/30000 (0.0%) | NA |
| PacIsl | Indicator race = Native Hawaiian or Other Pacific Islander (0 = White) | 0/30000 (0.0%) | NA |
| Multiracial | Indicator race = Multiracial (0 = White) | 0/30000 (0.0%) | NA |
| Other | Indicator race = Other (0 = White) | 0/30000 (0.0%) | NA |
| Notreported | Indicator race = Not reported (0 = White) | 0/30000 (0.0%) | NA |
| Unknown | Indicator race = unknown (0 = White) | 0/30000 (0.0%) | NA |
| HighRiskInd | Baseline covariate high risk pre-existing condition (1=yes, 0=no) | 0/30000 (0.0%) | NA |
| Sex | Sex assigned at birth (1=female, 0=male) | 0/30000 (0.0%) | NA |
| Age | Age at enrollment in years, between 18 and 85 | 0/30000 (0.0%) | NA |
| BMI | BMI at enrollment (kg/m^2) | 0/30000 (0.0%) | NA |

Table 2.2: All learner-screen combinations (28 in total) used as input to the Superlearner.

| Learner | Screen* |
|--------------------|---|
| SL.mean | all |
| SL.glm | all glmnet univar_logistic_pval highcor_random |
| SL.glm.interaction | glmnet univar_logistic_pval highcor_random |
| SL.glmnet | all |
| SL.gam | glmnet univar_logistic_pval highcor_random |
| SL.xgboost | all |
| SL.ranger.imp | all |

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

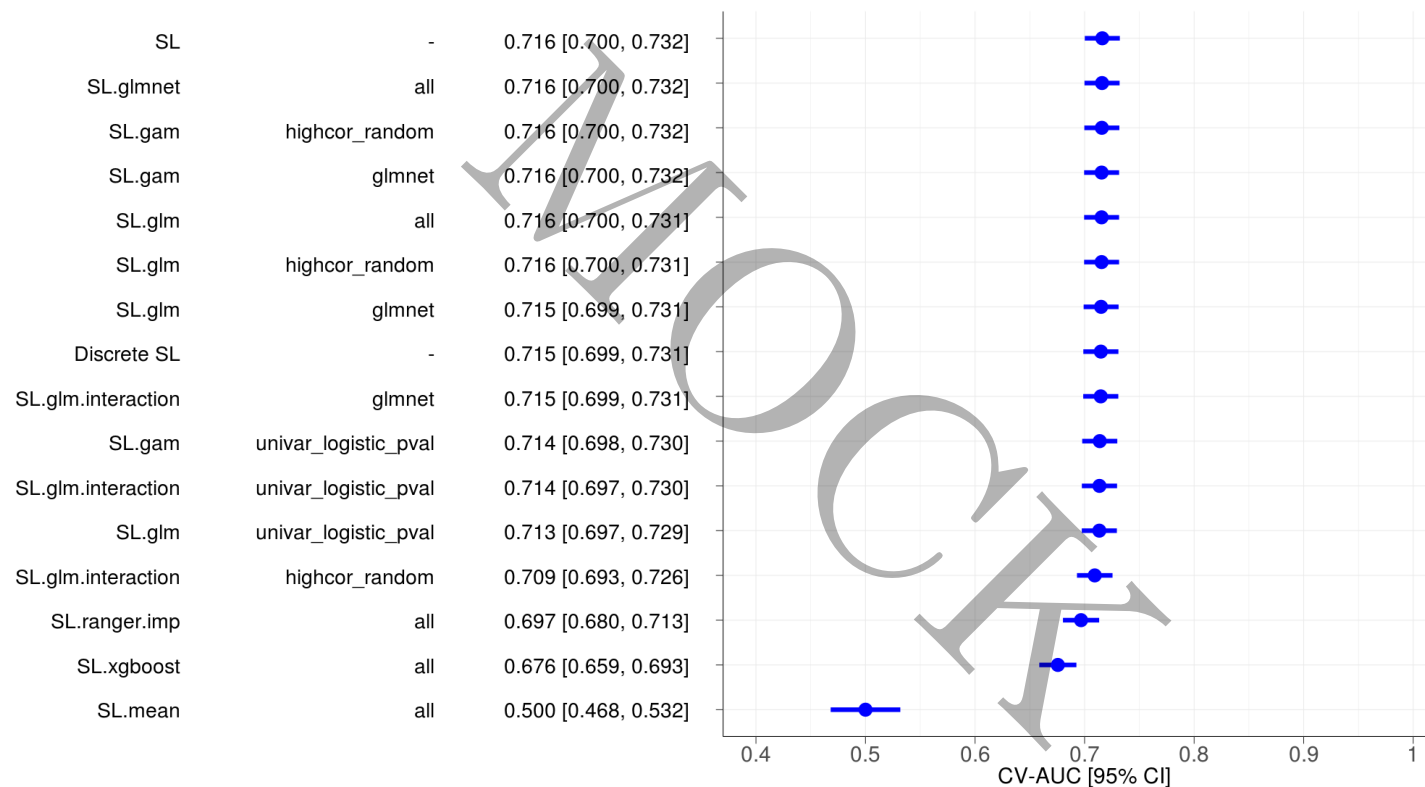


Figure 2.1: Cross-validated AUC (95% CI) of algorithms for predicting COVID-19 disease status starting 7 days after Day 57.



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.

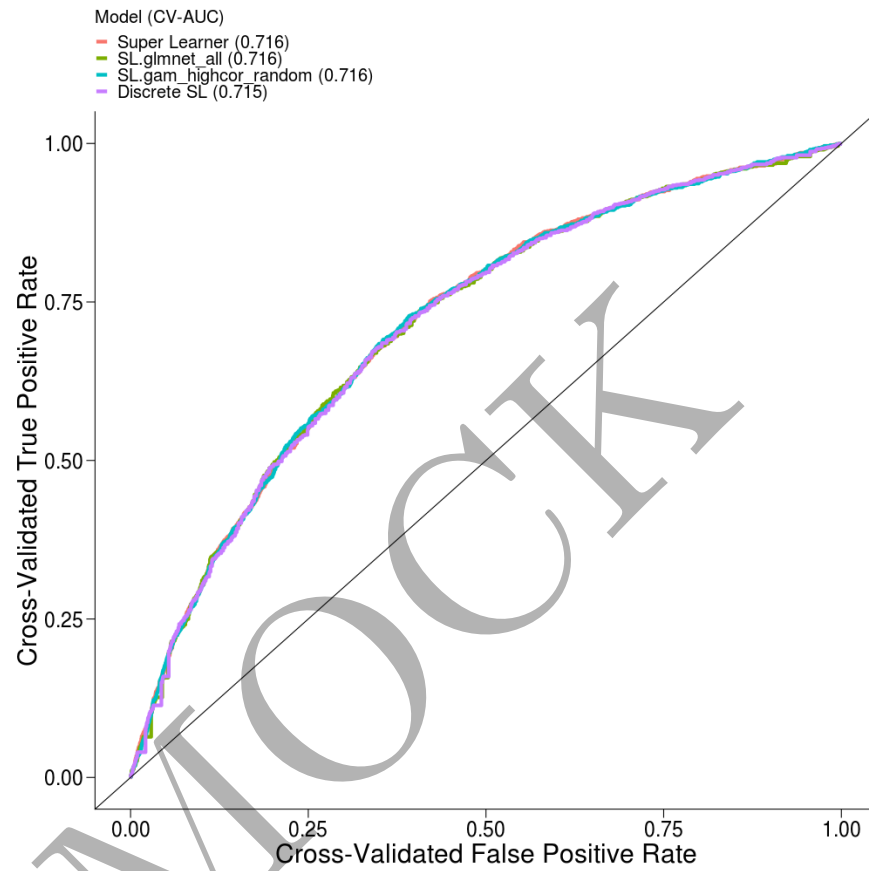


Figure 2.3: ROC curves based off CV-estimated predicted probabilities for the top 2 learners, Superlearner and Discrete SL.

Table 2.3: Weights assigned by Superlearner.

| Learner | Screen | Weight |
|--------------------|---------------------------------|--------|
| SL.glmnet | screen_all | 0.499 |
| SL.gam | screen_highcor_random | 0.274 |
| SL.ranger.imp | screen_all | 0.175 |
| SL.glm.interaction | screen_highcor_random | 0.046 |
| SL.glm.interaction | screen_glmnet | 0.006 |
| SL.mean | screen_all | 0.000 |
| SL.glm | screen_all | 0.000 |
| SL.xgboost | screen_all | 0.000 |
| SL.glm | screen_glmnet | 0.000 |
| SL.glm | screen_univariate_logistic_pval | 0.000 |
| SL.glm | screen_highcor_random | 0.000 |
| SL.glm.interaction | screen_univariate_logistic_pval | 0.000 |
| SL.gam | screen_glmnet | 0.000 |
| SL.gam | screen_univariate_logistic_pval | 0.000 |

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

| Learner | Screen | Weight | Predictors | Coefficient | Odds.Ratio | Importance |
|---------------|-----------------------|--------|----------------------|-------------|------------|------------|
| SL.glmnet | screen_all | 0.499 | (Intercept) | -2.564 | 0.077 | NA |
| SL.glmnet | screen_all | 0.499 | MinorityInd | 0.000 | 1.000 | NA |
| SL.glmnet | screen_all | 0.499 | EthnicityHispanic | 0.000 | 1.000 | NA |
| SL.glmnet | screen_all | 0.499 | EthnicityNotreported | 0.000 | 1.000 | NA |
| SL.glmnet | screen_all | 0.499 | EthnicityUnknown | 0.000 | 1.000 | NA |
| SL.glmnet | screen_all | 0.499 | Black | 0.000 | 1.000 | NA |
| SL.glmnet | screen_all | 0.499 | Asian | 0.000 | 1.000 | NA |
| SL.glmnet | screen_all | 0.499 | NatAmer | 0.000 | 1.000 | NA |
| SL.glmnet | screen_all | 0.499 | PacIsl | 0.000 | 1.000 | NA |
| SL.glmnet | screen_all | 0.499 | Multiracial | 0.000 | 1.000 | NA |
| SL.glmnet | screen_all | 0.499 | Other | 0.000 | 1.000 | NA |
| SL.glmnet | screen_all | 0.499 | Notreported | 0.000 | 1.000 | NA |
| SL.glmnet | screen_all | 0.499 | Unknown | 0.000 | 1.000 | NA |
| SL.glmnet | screen_all | 0.499 | HighRiskInd | 0.000 | 1.000 | NA |
| SL.glmnet | screen_all | 0.499 | Sex | 0.000 | 1.000 | NA |
| SL.glmnet | screen_all | 0.499 | Age | 0.441 | 1.555 | NA |
| SL.glmnet | screen_all | 0.499 | BMI | 0.000 | 1.000 | NA |
| SL.gam | screen_highcor_random | 0.274 | (Intercept) | -2.766 | 0.063 | NA |
| SL.gam | screen_highcor_random | 0.274 | s(Age,2) | 0.824 | 2.279 | NA |
| SL.gam | screen_highcor_random | 0.274 | s(BMI,2) | -0.045 | 0.956 | NA |
| SL.gam | screen_highcor_random | 0.274 | MinorityInd | -0.016 | 0.984 | NA |
| SL.gam | screen_highcor_random | 0.274 | EthnicityHispanic | -0.012 | 0.988 | NA |
| SL.gam | screen_highcor_random | 0.274 | EthnicityNotreported | 0.046 | 1.048 | NA |
| SL.gam | screen_highcor_random | 0.274 | EthnicityUnknown | -0.072 | 0.930 | NA |
| SL.gam | screen_highcor_random | 0.274 | Black | -0.024 | 0.977 | NA |
| SL.gam | screen_highcor_random | 0.274 | Asian | 0.056 | 1.058 | NA |
| SL.gam | screen_highcor_random | 0.274 | NatAmer | 0.007 | 1.007 | NA |
| SL.gam | screen_highcor_random | 0.274 | PacIsl | -0.025 | 0.975 | NA |
| SL.gam | screen_highcor_random | 0.274 | Multiracial | -0.052 | 0.949 | NA |
| SL.gam | screen_highcor_random | 0.274 | Other | 0.055 | 1.056 | NA |
| SL.gam | screen_highcor_random | 0.274 | Notreported | 0.006 | 1.007 | NA |
| SL.gam | screen_highcor_random | 0.274 | Unknown | 0.010 | 1.010 | NA |
| SL.gam | screen_highcor_random | 0.274 | HighRiskInd | -0.019 | 0.982 | NA |
| SL.gam | screen_highcor_random | 0.274 | Sex | -0.006 | 0.994 | NA |
| SL.ranger.imp | screen_all | 0.175 | MinorityInd | NA | NA | 9.726 |
| SL.ranger.imp | screen_all | 0.175 | EthnicityHispanic | NA | NA | 9.655 |
| SL.ranger.imp | screen_all | 0.175 | EthnicityNotreported | NA | NA | 9.472 |
| SL.ranger.imp | screen_all | 0.175 | EthnicityUnknown | NA | NA | 7.189 |
| SL.ranger.imp | screen_all | 0.175 | Black | NA | NA | 9.791 |
| SL.ranger.imp | screen_all | 0.175 | Asian | NA | NA | 7.580 |
| SL.ranger.imp | screen_all | 0.175 | NatAmer | NA | NA | 5.165 |
| SL.ranger.imp | screen_all | 0.175 | PacIsl | NA | NA | 2.699 |
| SL.ranger.imp | screen_all | 0.175 | Multiracial | NA | NA | 5.277 |
| SL.ranger.imp | screen_all | 0.175 | Other | NA | NA | 6.424 |
| SL.ranger.imp | screen_all | 0.175 | Notreported | NA | NA | 7.275 |

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

| Learner | Screen | Weight | Predictors | Coefficient | Odds.Ratio | Importance |
|--------------------|-----------------------|--------|--|-------------|------------|------------|
| SL.ranger.imp | screen_all | 0.175 | Unknown | NA | NA | 4.573 |
| SL.ranger.imp | screen_all | 0.175 | HighRiskInd | NA | NA | 18.257 |
| SL.ranger.imp | screen_all | 0.175 | Sex | NA | NA | 18.019 |
| SL.ranger.imp | screen_all | 0.175 | Age | NA | NA | 189.769 |
| SL.ranger.imp | screen_all | 0.175 | BMI | NA | NA | 236.556 |
| SL.glm.interaction | screen_highcor_random | 0.046 | (Intercept) | -2.907 | 0.055 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | MinorityInd | 0.202 | 1.224 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | EthnicityHispanic | -0.139 | 0.870 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | EthnicityNotreported | -0.089 | 0.915 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | EthnicityUnknown | -0.287 | 0.750 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | Black | -0.200 | 0.819 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | Asian | -0.071 | 0.931 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | NatAmer | -0.153 | 0.858 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | PacIsl | -0.201 | 0.818 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | Multiracial | -0.490 | 0.613 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | Other | 0.048 | 1.050 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | Notreported | -0.041 | 0.959 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | Unknown | 0.023 | 1.024 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | HighRiskInd | -0.051 | 0.951 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | Sex | 0.045 | 1.046 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | Age | 0.857 | 2.355 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | BMI | -0.063 | 0.939 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | MinorityInd:EthnicityHispanic | NA | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | MinorityInd:EthnicityNotreported | 0.087 | 1.091 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | MinorityInd:EthnicityUnknown | 0.211 | 1.234 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | MinorityInd:Black | NA | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | MinorityInd:Asian | NA | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | MinorityInd:NatAmer | NA | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | MinorityInd:PacIsl | NA | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | MinorityInd:Multiracial | NA | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | MinorityInd:Other | NA | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | MinorityInd:Notreported | -0.073 | 0.929 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | MinorityInd:Unknown | 0.028 | 1.029 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | MinorityInd:HighRiskInd | 0.142 | 1.153 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | MinorityInd:Sex | -0.001 | 0.999 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | MinorityInd:Age | 0.171 | 1.187 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | MinorityInd:BMI | -0.017 | 0.983 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | EthnicityHispanic:EthnicityNotreported | NA | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | EthnicityHispanic:EthnicityUnknown | NA | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | EthnicityHispanic:Black | 0.069 | 1.072 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | EthnicityHispanic:Asian | 0.037 | 1.038 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | EthnicityHispanic:NatAmer | 0.065 | 1.067 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | EthnicityHispanic:PacIsl | NA | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | EthnicityHispanic:Multiracial | 0.029 | 1.029 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | EthnicityHispanic:Other | NA | NA | NA |

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

| Learner | Screen | Weight | Predictors | Coefficient | Odds.Ratio | Importance |
|--------------------|-----------------------|--------|---------------------------------------|-------------|------------|------------|
| SL.glm.interaction | screen_highcor_random | 0.046 | EthnicityHispanic:Notreported | NA | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | EthnicityHispanic:Unknown | NA | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | EthnicityHispanic:HighRiskInd | -0.126 | 0.882 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | EthnicityHispanic:Sex | -0.010 | 0.990 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | EthnicityHispanic:Age | -0.017 | 0.983 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | EthnicityHispanic:BMI | -0.107 | 0.899 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | EthnicityNotreported:EthnicityUnknown | NA | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | EthnicityNotreported:Black | -0.023 | 0.977 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | EthnicityNotreported:Asian | -0.036 | 0.965 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | EthnicityNotreported:NatAmer | 0.043 | 1.044 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | EthnicityNotreported:PacIsl | -0.285 | 0.752 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | EthnicityNotreported:Multiracial | -0.570 | 0.565 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | EthnicityNotreported:Other | NA | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | EthnicityNotreported:Notreported | -0.012 | 0.988 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | EthnicityNotreported:Unknown | 0.000 | 1.000 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | EthnicityNotreported:HighRiskInd | -0.072 | 0.930 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | EthnicityNotreported:Sex | -0.017 | 0.983 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | EthnicityNotreported:Age | 0.000 | 1.000 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | EthnicityNotreported:BMI | 0.033 | 1.034 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | EthnicityUnknown:Black | -0.150 | 0.861 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | EthnicityUnknown:Asian | -0.156 | 0.855 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | EthnicityUnknown:NatAmer | -0.063 | 0.938 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | EthnicityUnknown:PacIsl | -0.299 | 0.742 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | EthnicityUnknown:Multiracial | -0.623 | 0.536 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | EthnicityUnknown:Other | NA | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | EthnicityUnknown:Notreported | 0.016 | 1.016 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | EthnicityUnknown:Unknown | -0.004 | 0.996 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | EthnicityUnknown:HighRiskInd | -0.020 | 0.980 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | EthnicityUnknown:Sex | 0.003 | 1.003 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | EthnicityUnknown:Age | 0.119 | 1.126 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | EthnicityUnknown:BMI | -0.074 | 0.928 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | Black:Asian | NA | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | Black:NatAmer | NA | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | Black:PacIsl | NA | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | Black:Multiracial | NA | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | Black:Other | NA | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | Black:Notreported | NA | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | Black:Unknown | NA | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | Black:HighRiskInd | -0.108 | 0.897 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | Black:Sex | 0.045 | 1.046 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | Black:Age | -0.098 | 0.907 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | Black:BMI | -0.014 | 0.987 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | Asian:NatAmer | NA | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | Asian:PacIsl | NA | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | Asian:Multiracial | NA | NA | NA |

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

| Learner | Screen | Weight | Predictors | Coefficient | Odds.Ratio | Importance |
|--------------------|-----------------------|--------|-------------------------|-------------|------------|------------|
| SL.glm.interaction | screen_highcor_random | 0.046 | Asian:Other | NA | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | Asian:Notreported | NA | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | Asian:Unknown | NA | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | Asian:HighRiskInd | -0.028 | 0.972 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | Asian:Sex | 0.041 | 1.041 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | Asian:Age | -0.047 | 0.954 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | Asian:BMI | -0.036 | 0.965 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | NatAmer:PacIsl | NA | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | NatAmer:Multiracial | NA | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | NatAmer:Other | NA | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | NatAmer:Notreported | NA | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | NatAmer:Unknown | NA | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | NatAmer:HighRiskInd | 0.067 | 1.069 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | NatAmer:Sex | 0.011 | 1.011 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | NatAmer:Age | 0.061 | 1.063 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | NatAmer:BMI | -0.031 | 0.970 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | PacIsl:Multiracial | NA | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | PacIsl:Other | NA | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | PacIsl:Notreported | NA | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | PacIsl:Unknown | NA | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | PacIsl:HighRiskInd | -0.021 | 0.979 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | PacIsl:Sex | 0.017 | 1.017 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | PacIsl:Age | -0.045 | 0.956 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | PacIsl:BMI | 0.054 | 1.056 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | Multiracial:Other | NA | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | Multiracial:Notreported | NA | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | Multiracial:Unknown | NA | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | Multiracial:HighRiskInd | -0.085 | 0.919 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | Multiracial:Sex | 0.032 | 1.032 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | Multiracial:Age | 0.047 | 1.048 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | Multiracial:BMI | 0.053 | 1.055 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | Other:Notreported | NA | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | Other:Unknown | NA | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | Other:HighRiskInd | 0.033 | 1.034 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | Other:Sex | 0.021 | 1.021 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | Other:Age | -0.052 | 0.949 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | Other:BMI | 0.074 | 1.077 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | Notreported:Unknown | NA | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | Notreported:HighRiskInd | 0.043 | 1.044 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | Notreported:Sex | 0.026 | 1.027 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | Notreported:Age | 0.005 | 1.005 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | Notreported:BMI | -0.008 | 0.992 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | Unknown:HighRiskInd | 0.012 | 1.012 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | Unknown:Sex | 0.048 | 1.049 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | Unknown:Age | -0.028 | 0.972 | NA |

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

| Learner | Screen | Weight | Predictors | Coefficient | Odds.Ratio | Importance |
|--------------------|-----------------------|--------|---------------------------------------|-------------|------------|------------|
| SL.glm.interaction | screen_highcor_random | 0.046 | Unknown:BMI | -0.065 | 0.937 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | HighRiskInd:Sex | -0.043 | 0.958 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | HighRiskInd:Age | 0.029 | 1.030 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | HighRiskInd:BMI | -0.105 | 0.900 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | Sex:Age | -0.088 | 0.916 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | Sex:BMI | 0.012 | 1.012 | NA |
| SL.glm.interaction | screen_highcor_random | 0.046 | Age:BMI | 0.008 | 1.008 | NA |
| SL.glm.interaction | screen_glmnet | 0.006 | (Intercept) | -2.846 | 0.058 | NA |
| SL.glm.interaction | screen_glmnet | 0.006 | EthnicityNotreported | -0.068 | 0.934 | NA |
| SL.glm.interaction | screen_glmnet | 0.006 | EthnicityUnknown | -0.280 | 0.755 | NA |
| SL.glm.interaction | screen_glmnet | 0.006 | Black | -0.048 | 0.954 | NA |
| SL.glm.interaction | screen_glmnet | 0.006 | Asian | 0.025 | 1.026 | NA |
| SL.glm.interaction | screen_glmnet | 0.006 | Multiracial | -0.406 | 0.667 | NA |
| SL.glm.interaction | screen_glmnet | 0.006 | Other | 0.065 | 1.068 | NA |
| SL.glm.interaction | screen_glmnet | 0.006 | Age | 0.842 | 2.320 | NA |
| SL.glm.interaction | screen_glmnet | 0.006 | BMI | -0.057 | 0.945 | NA |
| SL.glm.interaction | screen_glmnet | 0.006 | EthnicityNotreported:EthnicityUnknown | NA | NA | NA |
| SL.glm.interaction | screen_glmnet | 0.006 | EthnicityNotreported:Black | 0.040 | 1.041 | NA |
| SL.glm.interaction | screen_glmnet | 0.006 | EthnicityNotreported:Asian | -0.001 | 0.999 | NA |
| SL.glm.interaction | screen_glmnet | 0.006 | EthnicityNotreported:Multiracial | -0.546 | 0.579 | NA |
| SL.glm.interaction | screen_glmnet | 0.006 | EthnicityNotreported:Other | 0.036 | 1.037 | NA |
| SL.glm.interaction | screen_glmnet | 0.006 | EthnicityNotreported:Age | -0.003 | 0.997 | NA |
| SL.glm.interaction | screen_glmnet | 0.006 | EthnicityNotreported:BMI | 0.044 | 1.045 | NA |
| SL.glm.interaction | screen_glmnet | 0.006 | EthnicityUnknown:Black | 0.004 | 1.004 | NA |
| SL.glm.interaction | screen_glmnet | 0.006 | EthnicityUnknown:Asian | -0.058 | 0.943 | NA |
| SL.glm.interaction | screen_glmnet | 0.006 | EthnicityUnknown:Multiracial | -0.527 | 0.590 | NA |
| SL.glm.interaction | screen_glmnet | 0.006 | EthnicityUnknown:Other | 0.062 | 1.064 | NA |
| SL.glm.interaction | screen_glmnet | 0.006 | EthnicityUnknown:Age | 0.118 | 1.125 | NA |
| SL.glm.interaction | screen_glmnet | 0.006 | EthnicityUnknown:BMI | -0.064 | 0.938 | NA |
| SL.glm.interaction | screen_glmnet | 0.006 | Black:Asian | NA | NA | NA |
| SL.glm.interaction | screen_glmnet | 0.006 | Black:Multiracial | NA | NA | NA |
| SL.glm.interaction | screen_glmnet | 0.006 | Black:Other | NA | NA | NA |
| SL.glm.interaction | screen_glmnet | 0.006 | Black:Age | 0.014 | 1.014 | NA |
| SL.glm.interaction | screen_glmnet | 0.006 | Black:BMI | -0.027 | 0.973 | NA |
| SL.glm.interaction | screen_glmnet | 0.006 | Asian:Multiracial | NA | NA | NA |
| SL.glm.interaction | screen_glmnet | 0.006 | Asian:Other | NA | NA | NA |
| SL.glm.interaction | screen_glmnet | 0.006 | Asian:Age | 0.024 | 1.024 | NA |
| SL.glm.interaction | screen_glmnet | 0.006 | Asian:BMI | -0.046 | 0.956 | NA |
| SL.glm.interaction | screen_glmnet | 0.006 | Multiracial:Other | NA | NA | NA |
| SL.glm.interaction | screen_glmnet | 0.006 | Multiracial:Age | 0.097 | 1.102 | NA |
| SL.glm.interaction | screen_glmnet | 0.006 | Multiracial:BMI | 0.010 | 1.011 | NA |
| SL.glm.interaction | screen_glmnet | 0.006 | Other:Age | -0.013 | 0.987 | NA |
| SL.glm.interaction | screen_glmnet | 0.006 | Other:BMI | 0.038 | 1.039 | NA |
| SL.glm.interaction | screen_glmnet | 0.006 | Age:BMI | 0.006 | 1.006 | NA |
| SL.glm.interaction | screen_glmnet | 0.006 | (Intercept) | -2.846 | 0.058 | NA |

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

| Learner | Screen | Weight | Predictors | Coefficient | Odds.Ratio | Importance |
|--------------------|---------------|--------|---------------------------------------|-------------|------------|------------|
| SL.glm.interaction | screen_glmnet | 0.006 | EthnicityNotreported | -0.068 | 0.934 | NA |
| SL.glm.interaction | screen_glmnet | 0.006 | EthnicityUnknown | -0.280 | 0.755 | NA |
| SL.glm.interaction | screen_glmnet | 0.006 | Black | -0.048 | 0.954 | NA |
| SL.glm.interaction | screen_glmnet | 0.006 | Asian | 0.025 | 1.026 | NA |
| SL.glm.interaction | screen_glmnet | 0.006 | Multiracial | -0.406 | 0.667 | NA |
| SL.glm.interaction | screen_glmnet | 0.006 | Other | 0.065 | 1.068 | NA |
| SL.glm.interaction | screen_glmnet | 0.006 | Age | 0.842 | 2.320 | NA |
| SL.glm.interaction | screen_glmnet | 0.006 | BMI | -0.057 | 0.945 | NA |
| SL.glm.interaction | screen_glmnet | 0.006 | EthnicityNotreported:EthnicityUnknown | NA | NA | NA |
| SL.glm.interaction | screen_glmnet | 0.006 | EthnicityNotreported:Black | 0.040 | 1.041 | NA |
| SL.glm.interaction | screen_glmnet | 0.006 | EthnicityNotreported:Asian | -0.001 | 0.999 | NA |
| SL.glm.interaction | screen_glmnet | 0.006 | EthnicityNotreported:Multiracial | -0.546 | 0.579 | NA |
| SL.glm.interaction | screen_glmnet | 0.006 | EthnicityNotreported:Other | 0.036 | 1.037 | NA |
| SL.glm.interaction | screen_glmnet | 0.006 | EthnicityNotreported:Age | -0.003 | 0.997 | NA |
| SL.glm.interaction | screen_glmnet | 0.006 | EthnicityNotreported:BMI | 0.044 | 1.045 | NA |
| SL.glm.interaction | screen_glmnet | 0.006 | EthnicityUnknown:Black | 0.004 | 1.004 | NA |
| SL.glm.interaction | screen_glmnet | 0.006 | EthnicityUnknown:Asian | -0.058 | 0.943 | NA |
| SL.glm.interaction | screen_glmnet | 0.006 | EthnicityUnknown:Multiracial | -0.527 | 0.590 | NA |
| SL.glm.interaction | screen_glmnet | 0.006 | EthnicityUnknown:Other | 0.062 | 1.064 | NA |
| SL.glm.interaction | screen_glmnet | 0.006 | EthnicityUnknown:Age | 0.118 | 1.125 | NA |
| SL.glm.interaction | screen_glmnet | 0.006 | EthnicityUnknown:BMI | -0.064 | 0.938 | NA |
| SL.glm.interaction | screen_glmnet | 0.006 | Black:Asian | NA | NA | NA |
| SL.glm.interaction | screen_glmnet | 0.006 | Black:Multiracial | NA | NA | NA |
| SL.glm.interaction | screen_glmnet | 0.006 | Black:Other | NA | NA | NA |
| SL.glm.interaction | screen_glmnet | 0.006 | Black:Age | 0.014 | 1.014 | NA |
| SL.glm.interaction | screen_glmnet | 0.006 | Black:BMI | -0.027 | 0.973 | NA |
| SL.glm.interaction | screen_glmnet | 0.006 | Asian:Multiracial | NA | NA | NA |
| SL.glm.interaction | screen_glmnet | 0.006 | Asian:Other | NA | NA | NA |
| SL.glm.interaction | screen_glmnet | 0.006 | Asian:Age | 0.024 | 1.024 | NA |
| SL.glm.interaction | screen_glmnet | 0.006 | Asian:BMI | -0.046 | 0.956 | NA |
| SL.glm.interaction | screen_glmnet | 0.006 | Multiracial:Other | NA | NA | NA |
| SL.glm.interaction | screen_glmnet | 0.006 | Multiracial:Age | 0.097 | 1.102 | NA |
| SL.glm.interaction | screen_glmnet | 0.006 | Multiracial:BMI | 0.010 | 1.011 | NA |
| SL.glm.interaction | screen_glmnet | 0.006 | Other:Age | -0.013 | 0.987 | NA |
| SL.glm.interaction | screen_glmnet | 0.006 | Other:BMI | 0.038 | 1.039 | NA |
| SL.glm.interaction | screen_glmnet | 0.006 | Age:BMI | 0.006 | 1.006 | NA |



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.

MOCK

Chapter 3

Appendix

- This report was built from the [CoVPN/correlates_reporting](https://github.com/CoVPN/correlates_reporting/commit/04c2c73a0998adffdacfa5b49aac9b2b00dd6df3) repository with commit hash 04c2c73a0998adffdacfa5b49aac9b2b00dd6df3. A diff of the changes introduced by that commit may be viewed at https://github.com/CoVPN/correlates_reporting/commit/04c2c73a0998adffdacfa5b49aac9b2b00dd6df3
- 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