

COVID-19 Baseline Risk Score Analysis Report

mock Study

USG COVID-19 Response Biostatistics Team

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Chapter 1

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

Table 1.1: 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 1.2: 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

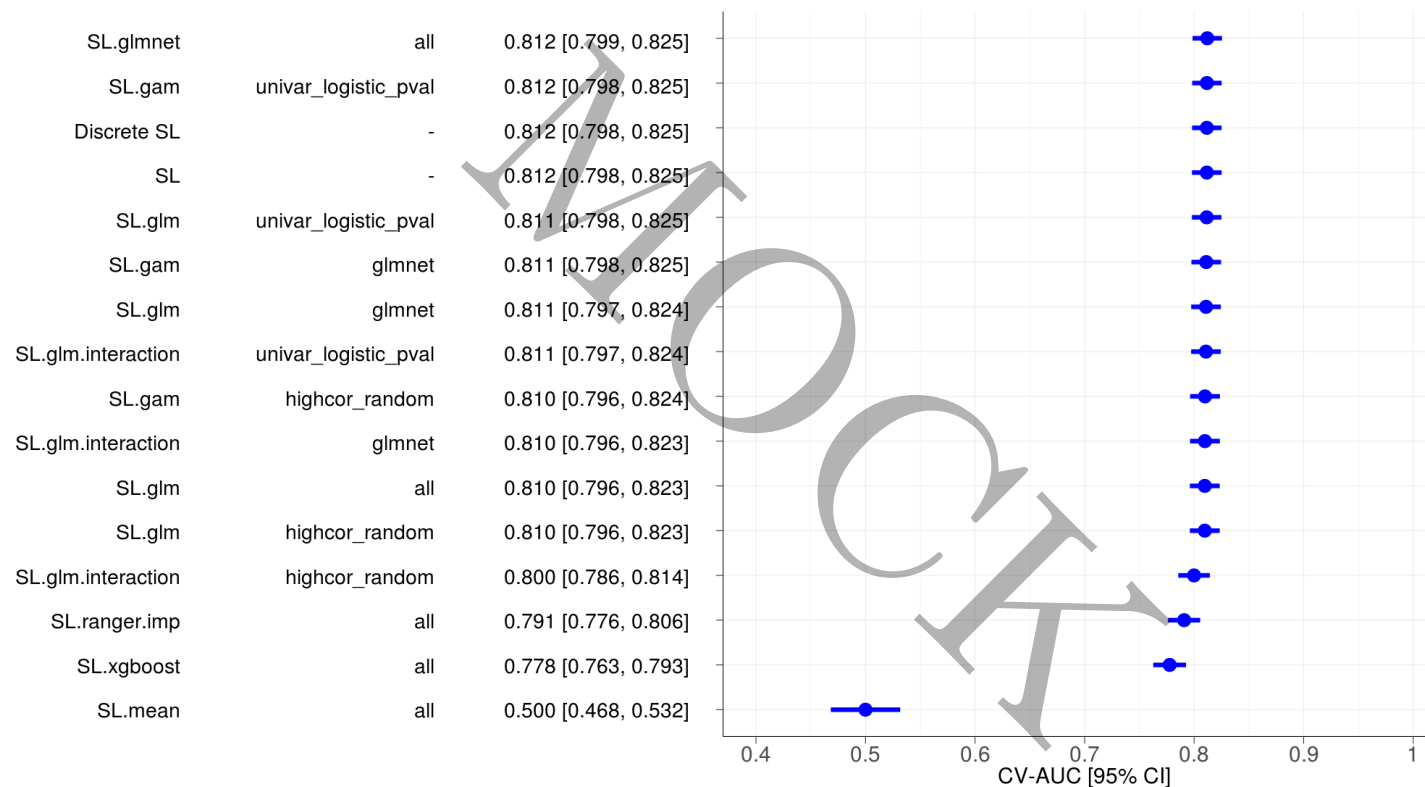


Figure 1.1: Cross-validated AUC (95% CI) of algorithms for predicting COVID-19 disease status starting 7 days after Day 57.

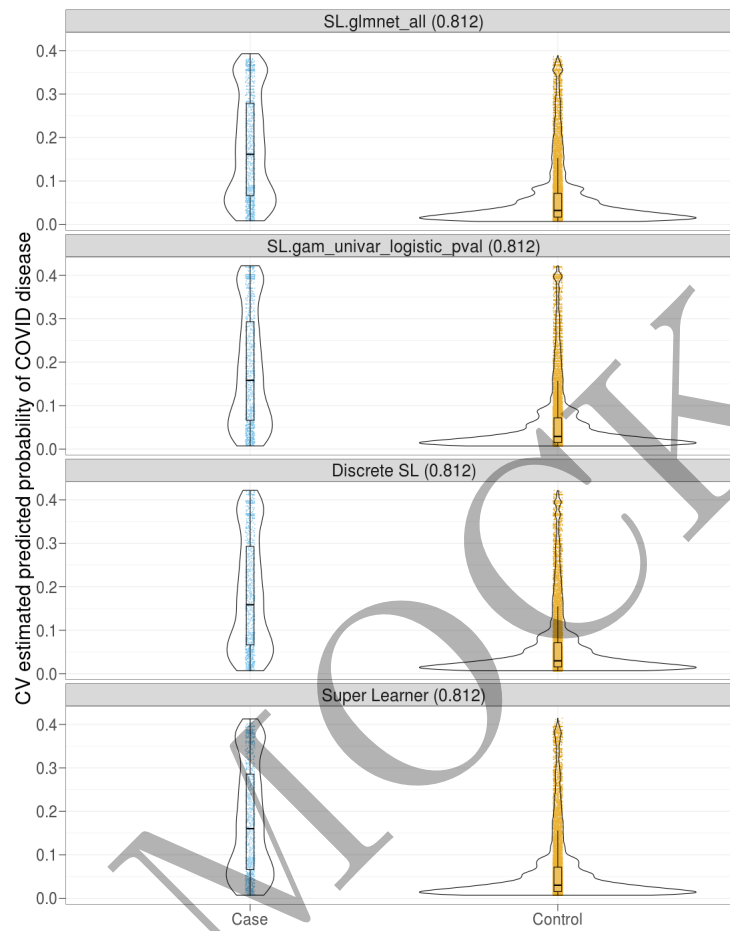


Figure 1.2: CV-estimated predicted probabilities of COVID-19 disease 7 days after Day 57 by case/control status for top 2 learners, SuperLearner and Discrete SL.

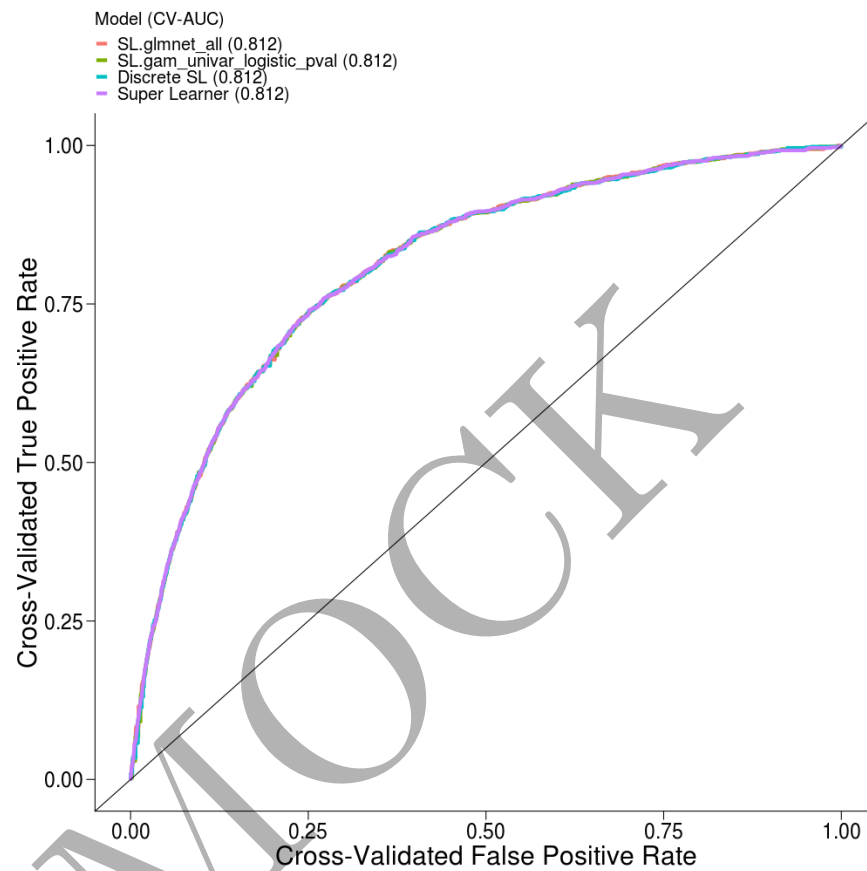


Figure 1.3: ROC curves based off CV-estimated predicted probabilities for the top 2 learners, Superlearner and Discrete SL.

Table 1.3: Weights assigned by Superlearner.

| Learner | Screen | Weight |
|--------------------|---------------------------------|--------|
| SL.gam | screen_univariate_logistic_pval | 0.531 |
| SL.glmnet | screen_all | 0.444 |
| SL.glm.interaction | screen_highcor_random | 0.025 |
| SL.mean | screen_all | 0.000 |
| SL.glm | screen_all | 0.000 |
| SL.xgboost | screen_all | 0.000 |
| SL.ranger.imp | 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_glmnet | 0.000 |
| SL.glm.interaction | screen_univariate_logistic_pval | 0.000 |
| SL.gam | screen_glmnet | 0.000 |
| SL.gam | screen_highcor_random | 0.000 |

Table 1.4: Predictors in learners assigned weight > 0.0 by Superlearner.

| Learner | Screen | Weight | Predictors | Coefficient | Odds.Ratio |
|--------------------|---------------------------------|--------|----------------------------------|-------------|------------|
| SL.gam | screen_univariate_logistic_pval | 0.531 | (Intercept) | -3.202 | 0.041 |
| SL.gam | screen_univariate_logistic_pval | 0.531 | s(Age,2) | 0.743 | 2.103 |
| SL.gam | screen_univariate_logistic_pval | 0.531 | HighRiskInd | 0.842 | 2.322 |
| SL.glmnet | screen_all | 0.444 | (Intercept) | -2.881 | 0.056 |
| SL.glmnet | screen_all | 0.444 | MinorityInd | 0.000 | 1.000 |
| SL.glmnet | screen_all | 0.444 | EthnicityHispanic | 0.000 | 1.000 |
| SL.glmnet | screen_all | 0.444 | EthnicityNotreported | 0.000 | 1.000 |
| SL.glmnet | screen_all | 0.444 | EthnicityUnknown | 0.000 | 1.000 |
| SL.glmnet | screen_all | 0.444 | Black | 0.000 | 1.000 |
| SL.glmnet | screen_all | 0.444 | Asian | 0.000 | 1.000 |
| SL.glmnet | screen_all | 0.444 | NatAmer | 0.000 | 1.000 |
| SL.glmnet | screen_all | 0.444 | PacIsl | 0.000 | 1.000 |
| SL.glmnet | screen_all | 0.444 | Multiracial | 0.000 | 1.000 |
| SL.glmnet | screen_all | 0.444 | Other | 0.000 | 1.000 |
| SL.glmnet | screen_all | 0.444 | Notreported | 0.000 | 1.000 |
| SL.glmnet | screen_all | 0.444 | Unknown | 0.000 | 1.000 |
| SL.glmnet | screen_all | 0.444 | HighRiskInd | 0.624 | 1.867 |
| SL.glmnet | screen_all | 0.444 | Sex | 0.000 | 1.000 |
| SL.glmnet | screen_all | 0.444 | Age | 0.444 | 1.560 |
| SL.glmnet | screen_all | 0.444 | BMI | 0.000 | 1.000 |
| SL.glm.interaction | screen_highcor_random | 0.025 | (Intercept) | -3.388 | 0.034 |
| SL.glm.interaction | screen_highcor_random | 0.025 | MinorityInd | -0.267 | 0.765 |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityHispanic | -0.022 | 0.978 |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityNotreported | -0.401 | 0.670 |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityUnknown | -0.090 | 0.914 |
| SL.glm.interaction | screen_highcor_random | 0.025 | Black | 0.254 | 1.289 |
| SL.glm.interaction | screen_highcor_random | 0.025 | Asian | 0.060 | 1.061 |
| SL.glm.interaction | screen_highcor_random | 0.025 | NatAmer | -0.012 | 0.988 |
| SL.glm.interaction | screen_highcor_random | 0.025 | PacIsl | -0.085 | 0.918 |
| SL.glm.interaction | screen_highcor_random | 0.025 | Multiracial | -0.117 | 0.889 |
| SL.glm.interaction | screen_highcor_random | 0.025 | Other | -0.073 | 0.929 |
| SL.glm.interaction | screen_highcor_random | 0.025 | Notreported | 0.018 | 1.018 |
| SL.glm.interaction | screen_highcor_random | 0.025 | Unknown | -0.073 | 0.929 |
| SL.glm.interaction | screen_highcor_random | 0.025 | HighRiskInd | 0.880 | 2.412 |
| SL.glm.interaction | screen_highcor_random | 0.025 | Sex | 0.069 | 1.071 |
| SL.glm.interaction | screen_highcor_random | 0.025 | Age | 0.806 | 2.239 |
| SL.glm.interaction | screen_highcor_random | 0.025 | BMI | -0.024 | 0.976 |
| SL.glm.interaction | screen_highcor_random | 0.025 | MinorityInd:EthnicityHispanic | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | MinorityInd:EthnicityNotreported | -1.351 | 0.259 |
| SL.glm.interaction | screen_highcor_random | 0.025 | MinorityInd:EthnicityUnknown | 0.106 | 1.112 |
| SL.glm.interaction | screen_highcor_random | 0.025 | MinorityInd:Black | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | MinorityInd:Asian | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | MinorityInd:NatAmer | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | MinorityInd:PacIsl | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | MinorityInd:Multiracial | NA | NA |

Table 1.4: Predictors in learners assigned weight > 0.0 by Superlearner. (continued)

| Learner | Screen | Weight | Predictors | Coefficient | Odds.Ratio |
|--------------------|-----------------------|--------|--|-------------|------------|
| SL.glm.interaction | screen_highcor_random | 0.025 | MinorityInd:Other | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | MinorityInd:Notreported | 0.054 | 1.055 |
| SL.glm.interaction | screen_highcor_random | 0.025 | MinorityInd:Unknown | 0.045 | 1.046 |
| SL.glm.interaction | screen_highcor_random | 0.025 | MinorityInd:HighRiskInd | 0.196 | 1.217 |
| SL.glm.interaction | screen_highcor_random | 0.025 | MinorityInd:Sex | 0.181 | 1.199 |
| SL.glm.interaction | screen_highcor_random | 0.025 | MinorityInd:Age | -0.201 | 0.818 |
| SL.glm.interaction | screen_highcor_random | 0.025 | MinorityInd:BMI | 0.087 | 1.091 |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityHispanic:EthnicityNotreported | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityHispanic:EthnicityUnknown | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityHispanic:Black | -0.018 | 0.982 |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityHispanic:Asian | -0.096 | 0.908 |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityHispanic:NatAmer | 0.028 | 1.029 |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityHispanic:PacIsl | 0.279 | 1.321 |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityHispanic:Multiracial | 0.049 | 1.050 |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityHispanic:Other | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityHispanic:Notreported | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityHispanic:Unknown | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityHispanic:HighRiskInd | -0.081 | 0.923 |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityHispanic:Sex | -0.073 | 0.929 |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityHispanic:Age | 0.118 | 1.125 |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityHispanic:BMI | -0.085 | 0.919 |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityNotreported:EthnicityUnknown | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityNotreported:Black | 0.972 | 2.643 |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityNotreported:Asian | 0.643 | 1.902 |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityNotreported:NatAmer | -0.011 | 0.989 |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityNotreported:PacIsl | 0.369 | 1.446 |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityNotreported:Multiracial | 0.046 | 1.047 |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityNotreported:Other | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityNotreported:Notreported | 0.000 | 1.000 |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityNotreported:Unknown | 0.023 | 1.024 |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityNotreported:HighRiskInd | 0.035 | 1.035 |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityNotreported:Sex | -0.117 | 0.889 |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityNotreported:Age | 0.011 | 1.011 |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityNotreported:BMI | -0.020 | 0.981 |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityUnknown:Black | -0.059 | 0.942 |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityUnknown:Asian | -0.075 | 0.928 |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityUnknown:NatAmer | -0.026 | 0.974 |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityUnknown:PacIsl | -0.309 | 0.734 |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityUnknown:Multiracial | -0.013 | 0.987 |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityUnknown:Other | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityUnknown:Notreported | 0.008 | 1.008 |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityUnknown:Unknown | 0.029 | 1.029 |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityUnknown:HighRiskInd | 0.044 | 1.045 |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityUnknown:Sex | -0.010 | 0.990 |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityUnknown:Age | 0.009 | 1.009 |

Table 1.4: Predictors in learners assigned weight > 0.0 by Superlearner. (continued)

| Learner | Screen | Weight | Predictors | Coefficient | Odds.Ratio |
|--------------------|-----------------------|--------|-------------------------|-------------|------------|
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityUnknown:BMI | -0.106 | 0.900 |
| SL.glm.interaction | screen_highcor_random | 0.025 | Black:Asian | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | Black:NatAmer | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | Black:PacIsl | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | Black:Multiracial | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | Black:Other | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | Black:Notreported | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | Black:Unknown | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | Black:HighRiskInd | -0.183 | 0.832 |
| SL.glm.interaction | screen_highcor_random | 0.025 | Black:Sex | -0.132 | 0.876 |
| SL.glm.interaction | screen_highcor_random | 0.025 | Black:Age | 0.181 | 1.199 |
| SL.glm.interaction | screen_highcor_random | 0.025 | Black:BMI | -0.058 | 0.944 |
| SL.glm.interaction | screen_highcor_random | 0.025 | Asian:NatAmer | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | Asian:PacIsl | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | Asian:Multiracial | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | Asian:Other | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | Asian:Notreported | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | Asian:Unknown | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | Asian:HighRiskInd | -0.061 | 0.941 |
| SL.glm.interaction | screen_highcor_random | 0.025 | Asian:Sex | -0.104 | 0.901 |
| SL.glm.interaction | screen_highcor_random | 0.025 | Asian:Age | 0.153 | 1.165 |
| SL.glm.interaction | screen_highcor_random | 0.025 | Asian:BMI | -0.078 | 0.925 |
| SL.glm.interaction | screen_highcor_random | 0.025 | NatAmer:PacIsl | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | NatAmer:Multiracial | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | NatAmer:Other | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | NatAmer:Notreported | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | NatAmer:Unknown | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | NatAmer:HighRiskInd | -0.086 | 0.918 |
| SL.glm.interaction | screen_highcor_random | 0.025 | NatAmer:Sex | -0.097 | 0.907 |
| SL.glm.interaction | screen_highcor_random | 0.025 | NatAmer:Age | -0.011 | 0.989 |
| SL.glm.interaction | screen_highcor_random | 0.025 | NatAmer:BMI | -0.060 | 0.941 |
| SL.glm.interaction | screen_highcor_random | 0.025 | PacIsl:Multiracial | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | PacIsl:Other | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | PacIsl:Notreported | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | PacIsl:Unknown | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | PacIsl:HighRiskInd | -0.052 | 0.949 |
| SL.glm.interaction | screen_highcor_random | 0.025 | PacIsl:Sex | -0.098 | 0.907 |
| SL.glm.interaction | screen_highcor_random | 0.025 | PacIsl:Age | 0.221 | 1.247 |
| SL.glm.interaction | screen_highcor_random | 0.025 | PacIsl:BMI | -0.011 | 0.989 |
| SL.glm.interaction | screen_highcor_random | 0.025 | Multiracial:Other | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | Multiracial:Notreported | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | Multiracial:Unknown | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | Multiracial:HighRiskInd | -0.053 | 0.948 |
| SL.glm.interaction | screen_highcor_random | 0.025 | Multiracial:Sex | -0.051 | 0.950 |
| SL.glm.interaction | screen_highcor_random | 0.025 | Multiracial:Age | 0.006 | 1.006 |

Table 1.4: Predictors in learners assigned weight > 0.0 by Superlearner. (continued)

| Learner | Screen | Weight | Predictors | Coefficient | Odds.Ratio |
|--------------------|-----------------------|--------|----------------------------------|-------------|------------|
| SL.glm.interaction | screen_highcor_random | 0.025 | Multiracial:BMI | -0.077 | 0.926 |
| SL.glm.interaction | screen_highcor_random | 0.025 | Other:Notreported | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | Other:Unknown | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | Other:HighRiskInd | -0.007 | 0.993 |
| SL.glm.interaction | screen_highcor_random | 0.025 | Other:Sex | -0.008 | 0.992 |
| SL.glm.interaction | screen_highcor_random | 0.025 | Other:Age | 0.027 | 1.027 |
| SL.glm.interaction | screen_highcor_random | 0.025 | Other:BMI | -0.066 | 0.936 |
| SL.glm.interaction | screen_highcor_random | 0.025 | Notreported:Unknown | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | Notreported:HighRiskInd | 0.021 | 1.021 |
| SL.glm.interaction | screen_highcor_random | 0.025 | Notreported:Sex | -0.043 | 0.958 |
| SL.glm.interaction | screen_highcor_random | 0.025 | Notreported:Age | 0.009 | 1.009 |
| SL.glm.interaction | screen_highcor_random | 0.025 | Notreported:BMI | -0.004 | 0.996 |
| SL.glm.interaction | screen_highcor_random | 0.025 | Unknown:HighRiskInd | 0.051 | 1.052 |
| SL.glm.interaction | screen_highcor_random | 0.025 | Unknown:Sex | -0.058 | 0.944 |
| SL.glm.interaction | screen_highcor_random | 0.025 | Unknown:Age | 0.027 | 1.028 |
| SL.glm.interaction | screen_highcor_random | 0.025 | Unknown:BMI | 0.010 | 1.010 |
| SL.glm.interaction | screen_highcor_random | 0.025 | HighRiskInd:Sex | 0.002 | 1.002 |
| SL.glm.interaction | screen_highcor_random | 0.025 | HighRiskInd:Age | -0.045 | 0.956 |
| SL.glm.interaction | screen_highcor_random | 0.025 | HighRiskInd:BMI | -0.017 | 0.983 |
| SL.glm.interaction | screen_highcor_random | 0.025 | Sex:Age | -0.026 | 0.974 |
| SL.glm.interaction | screen_highcor_random | 0.025 | Sex:BMI | -0.012 | 0.988 |
| SL.glm.interaction | screen_highcor_random | 0.025 | Age:BMI | -0.007 | 0.993 |
| SL.glm.interaction | screen_highcor_random | 0.025 | (Intercept) | -3.388 | 0.034 |
| SL.glm.interaction | screen_highcor_random | 0.025 | MinorityInd | -0.267 | 0.765 |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityHispanic | -0.022 | 0.978 |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityNotreported | -0.401 | 0.670 |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityUnknown | -0.090 | 0.914 |
| SL.glm.interaction | screen_highcor_random | 0.025 | Black | 0.254 | 1.289 |
| SL.glm.interaction | screen_highcor_random | 0.025 | Asian | 0.060 | 1.061 |
| SL.glm.interaction | screen_highcor_random | 0.025 | NatAmer | -0.012 | 0.988 |
| SL.glm.interaction | screen_highcor_random | 0.025 | PacIsl | -0.085 | 0.918 |
| SL.glm.interaction | screen_highcor_random | 0.025 | Multiracial | -0.117 | 0.889 |
| SL.glm.interaction | screen_highcor_random | 0.025 | Other | -0.073 | 0.929 |
| SL.glm.interaction | screen_highcor_random | 0.025 | Notreported | 0.018 | 1.018 |
| SL.glm.interaction | screen_highcor_random | 0.025 | Unknown | -0.073 | 0.929 |
| SL.glm.interaction | screen_highcor_random | 0.025 | HighRiskInd | 0.880 | 2.412 |
| SL.glm.interaction | screen_highcor_random | 0.025 | Sex | 0.069 | 1.071 |
| SL.glm.interaction | screen_highcor_random | 0.025 | Age | 0.806 | 2.239 |
| SL.glm.interaction | screen_highcor_random | 0.025 | BMI | -0.024 | 0.976 |
| SL.glm.interaction | screen_highcor_random | 0.025 | MinorityInd:EthnicityHispanic | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | MinorityInd:EthnicityNotreported | -1.351 | 0.259 |
| SL.glm.interaction | screen_highcor_random | 0.025 | MinorityInd:EthnicityUnknown | 0.106 | 1.112 |
| SL.glm.interaction | screen_highcor_random | 0.025 | MinorityInd:Black | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | MinorityInd:Asian | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | MinorityInd:NatAmer | NA | NA |

Table 1.4: Predictors in learners assigned weight > 0.0 by Superlearner. (continued)

| Learner | Screen | Weight | Predictors | Coefficient | Odds.Ratio |
|--------------------|-----------------------|--------|--|-------------|------------|
| SL.glm.interaction | screen_highcor_random | 0.025 | MinorityInd:PacIsl | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | MinorityInd:Multiracial | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | MinorityInd:Other | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | MinorityInd:Notreported | 0.054 | 1.055 |
| SL.glm.interaction | screen_highcor_random | 0.025 | MinorityInd:Unknown | 0.045 | 1.046 |
| SL.glm.interaction | screen_highcor_random | 0.025 | MinorityInd:HighRiskInd | 0.196 | 1.217 |
| SL.glm.interaction | screen_highcor_random | 0.025 | MinorityInd:Sex | 0.181 | 1.199 |
| SL.glm.interaction | screen_highcor_random | 0.025 | MinorityInd:Age | -0.201 | 0.818 |
| SL.glm.interaction | screen_highcor_random | 0.025 | MinorityInd:BMI | 0.087 | 1.091 |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityHispanic:EthnicityNotreported | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityHispanic:EthnicityUnknown | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityHispanic:Black | -0.018 | 0.982 |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityHispanic:Asian | -0.096 | 0.908 |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityHispanic:NatAmer | 0.028 | 1.029 |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityHispanic:PacIsl | 0.279 | 1.321 |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityHispanic:Multiracial | 0.049 | 1.050 |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityHispanic:Other | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityHispanic:Notreported | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityHispanic:Unknown | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityHispanic:HighRiskInd | -0.081 | 0.923 |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityHispanic:Sex | -0.073 | 0.929 |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityHispanic:Age | 0.118 | 1.125 |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityHispanic:BMI | -0.085 | 0.919 |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityNotreported:EthnicityUnknown | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityNotreported:Black | 0.972 | 2.643 |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityNotreported:Asian | 0.643 | 1.902 |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityNotreported:NatAmer | -0.011 | 0.989 |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityNotreported:PacIsl | 0.369 | 1.446 |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityNotreported:Multiracial | 0.046 | 1.047 |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityNotreported:Other | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityNotreported:Notreported | 0.000 | 1.000 |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityNotreported:Unknown | 0.023 | 1.024 |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityNotreported:HighRiskInd | 0.035 | 1.035 |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityNotreported:Sex | -0.117 | 0.889 |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityNotreported:Age | 0.011 | 1.011 |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityNotreported:BMI | -0.020 | 0.981 |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityUnknown:Black | -0.059 | 0.942 |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityUnknown:Asian | -0.075 | 0.928 |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityUnknown:NatAmer | -0.026 | 0.974 |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityUnknown:PacIsl | -0.309 | 0.734 |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityUnknown:Multiracial | -0.013 | 0.987 |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityUnknown:Other | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityUnknown:Notreported | 0.008 | 1.008 |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityUnknown:Unknown | 0.029 | 1.029 |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityUnknown:HighRiskInd | 0.044 | 1.045 |

Table 1.4: Predictors in learners assigned weight > 0.0 by Superlearner. (continued)

| Learner | Screen | Weight | Predictors | Coefficient | Odds.Ratio |
|--------------------|-----------------------|--------|-------------------------|-------------|------------|
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityUnknown:Sex | -0.010 | 0.990 |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityUnknown:Age | 0.009 | 1.009 |
| SL.glm.interaction | screen_highcor_random | 0.025 | EthnicityUnknown:BMI | -0.106 | 0.900 |
| SL.glm.interaction | screen_highcor_random | 0.025 | Black:Asian | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | Black:NatAmer | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | Black:PacIsl | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | Black:Multiracial | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | Black:Other | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | Black:Notreported | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | Black:Unknown | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | Black:HighRiskInd | -0.183 | 0.832 |
| SL.glm.interaction | screen_highcor_random | 0.025 | Black:Sex | -0.132 | 0.876 |
| SL.glm.interaction | screen_highcor_random | 0.025 | Black:Age | 0.181 | 1.199 |
| SL.glm.interaction | screen_highcor_random | 0.025 | Black:BMI | -0.058 | 0.944 |
| SL.glm.interaction | screen_highcor_random | 0.025 | Asian:NatAmer | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | Asian:PacIsl | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | Asian:Multiracial | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | Asian:Other | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | Asian:Notreported | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | Asian:Unknown | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | Asian:HighRiskInd | -0.061 | 0.941 |
| SL.glm.interaction | screen_highcor_random | 0.025 | Asian:Sex | -0.104 | 0.901 |
| SL.glm.interaction | screen_highcor_random | 0.025 | Asian:Age | 0.153 | 1.165 |
| SL.glm.interaction | screen_highcor_random | 0.025 | Asian:BMI | -0.078 | 0.925 |
| SL.glm.interaction | screen_highcor_random | 0.025 | NatAmer:PacIsl | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | NatAmer:Multiracial | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | NatAmer:Other | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | NatAmer:Notreported | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | NatAmer:Unknown | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | NatAmer:HighRiskInd | -0.086 | 0.918 |
| SL.glm.interaction | screen_highcor_random | 0.025 | NatAmer:Sex | -0.097 | 0.907 |
| SL.glm.interaction | screen_highcor_random | 0.025 | NatAmer:Age | -0.011 | 0.989 |
| SL.glm.interaction | screen_highcor_random | 0.025 | NatAmer:BMI | -0.060 | 0.941 |
| SL.glm.interaction | screen_highcor_random | 0.025 | PacIsl:Multiracial | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | PacIsl:Other | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | PacIsl:Notreported | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | PacIsl:Unknown | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | PacIsl:HighRiskInd | -0.052 | 0.949 |
| SL.glm.interaction | screen_highcor_random | 0.025 | PacIsl:Sex | -0.098 | 0.907 |
| SL.glm.interaction | screen_highcor_random | 0.025 | PacIsl:Age | 0.221 | 1.247 |
| SL.glm.interaction | screen_highcor_random | 0.025 | PacIsl:BMI | -0.011 | 0.989 |
| SL.glm.interaction | screen_highcor_random | 0.025 | Multiracial:Other | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | Multiracial:Notreported | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | Multiracial:Unknown | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | Multiracial:HighRiskInd | -0.053 | 0.948 |

Table 1.4: Predictors in learners assigned weight > 0.0 by Superlearner. (continued)

| Learner | Screen | Weight | Predictors | Coefficient | Odds.Ratio |
|--------------------|-----------------------|--------|-------------------------|-------------|------------|
| SL.glm.interaction | screen_highcor_random | 0.025 | Multiracial:Sex | -0.051 | 0.950 |
| SL.glm.interaction | screen_highcor_random | 0.025 | Multiracial:Age | 0.006 | 1.006 |
| SL.glm.interaction | screen_highcor_random | 0.025 | Multiracial:BMI | -0.077 | 0.926 |
| SL.glm.interaction | screen_highcor_random | 0.025 | Other:Notreported | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | Other:Unknown | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | Other:HighRiskInd | -0.007 | 0.993 |
| SL.glm.interaction | screen_highcor_random | 0.025 | Other:Sex | -0.008 | 0.992 |
| SL.glm.interaction | screen_highcor_random | 0.025 | Other:Age | 0.027 | 1.027 |
| SL.glm.interaction | screen_highcor_random | 0.025 | Other:BMI | -0.066 | 0.936 |
| SL.glm.interaction | screen_highcor_random | 0.025 | Notreported:Unknown | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.025 | Notreported:HighRiskInd | 0.021 | 1.021 |
| SL.glm.interaction | screen_highcor_random | 0.025 | Notreported:Sex | -0.043 | 0.958 |
| SL.glm.interaction | screen_highcor_random | 0.025 | Notreported:Age | 0.009 | 1.009 |
| SL.glm.interaction | screen_highcor_random | 0.025 | Notreported:BMI | -0.004 | 0.996 |
| SL.glm.interaction | screen_highcor_random | 0.025 | Unknown:HighRiskInd | 0.051 | 1.052 |
| SL.glm.interaction | screen_highcor_random | 0.025 | Unknown:Sex | -0.058 | 0.944 |
| SL.glm.interaction | screen_highcor_random | 0.025 | Unknown:Age | 0.027 | 1.028 |
| SL.glm.interaction | screen_highcor_random | 0.025 | Unknown:BMI | 0.010 | 1.010 |
| SL.glm.interaction | screen_highcor_random | 0.025 | HighRiskInd:Sex | 0.002 | 1.002 |
| SL.glm.interaction | screen_highcor_random | 0.025 | HighRiskInd:Age | -0.045 | 0.956 |
| SL.glm.interaction | screen_highcor_random | 0.025 | HighRiskInd:BMI | -0.017 | 0.983 |
| SL.glm.interaction | screen_highcor_random | 0.025 | Sex:Age | -0.026 | 0.974 |
| SL.glm.interaction | screen_highcor_random | 0.025 | Sex:BMI | -0.012 | 0.988 |
| SL.glm.interaction | screen_highcor_random | 0.025 | Age:BMI | -0.007 | 0.993 |

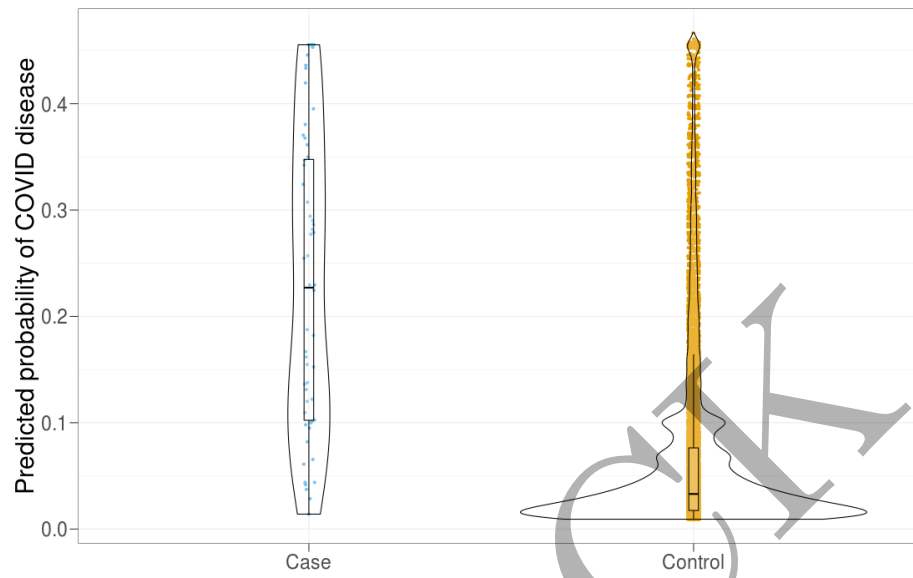


Figure 1.4: Superlearner predicted probabilities of COVID-19 disease in vaccinees 7 days after Day 57 by case/control status.

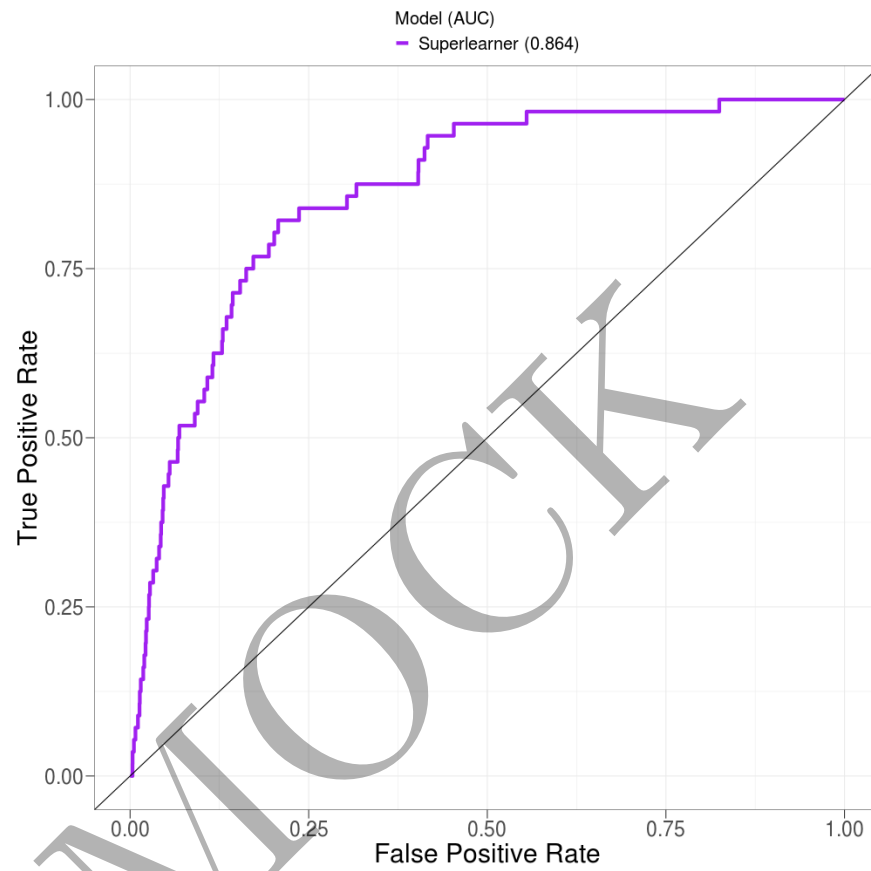


Figure 1.5: ROC curve based off Superlearner predicted probabilities in vaccinees.

Chapter 2

Appendix

- This report was built from the [CoVPN/correlates_reporting](https://github.com/CoVPN/correlates_reporting/commit/9b5eea0302503123836e3dff890ac8d62b947432) repository with commit hash 9b5eea0302503123836e3dff890ac8d62b947432. A diff of the changes introduced by that commit may be viewed at https://github.com/CoVPN/correlates_reporting/commit/9b5eea0302503123836e3dff890ac8d62b947432
- The sha256 hash sum of the raw input file, “COVID_VEtrial_practicedata_primarystage1.csv”:
9093a3d1fd6eb4b5523bfa7df143e1bc6e1f3ee0f6b340eaf60d3859e07a1023
- The sha256 hash sum of the processed file, “practice_data.csv”:
b3eb4a4bc4134968cce332b14e8bbd891517cf559f9a3459409f644db65a1810