

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

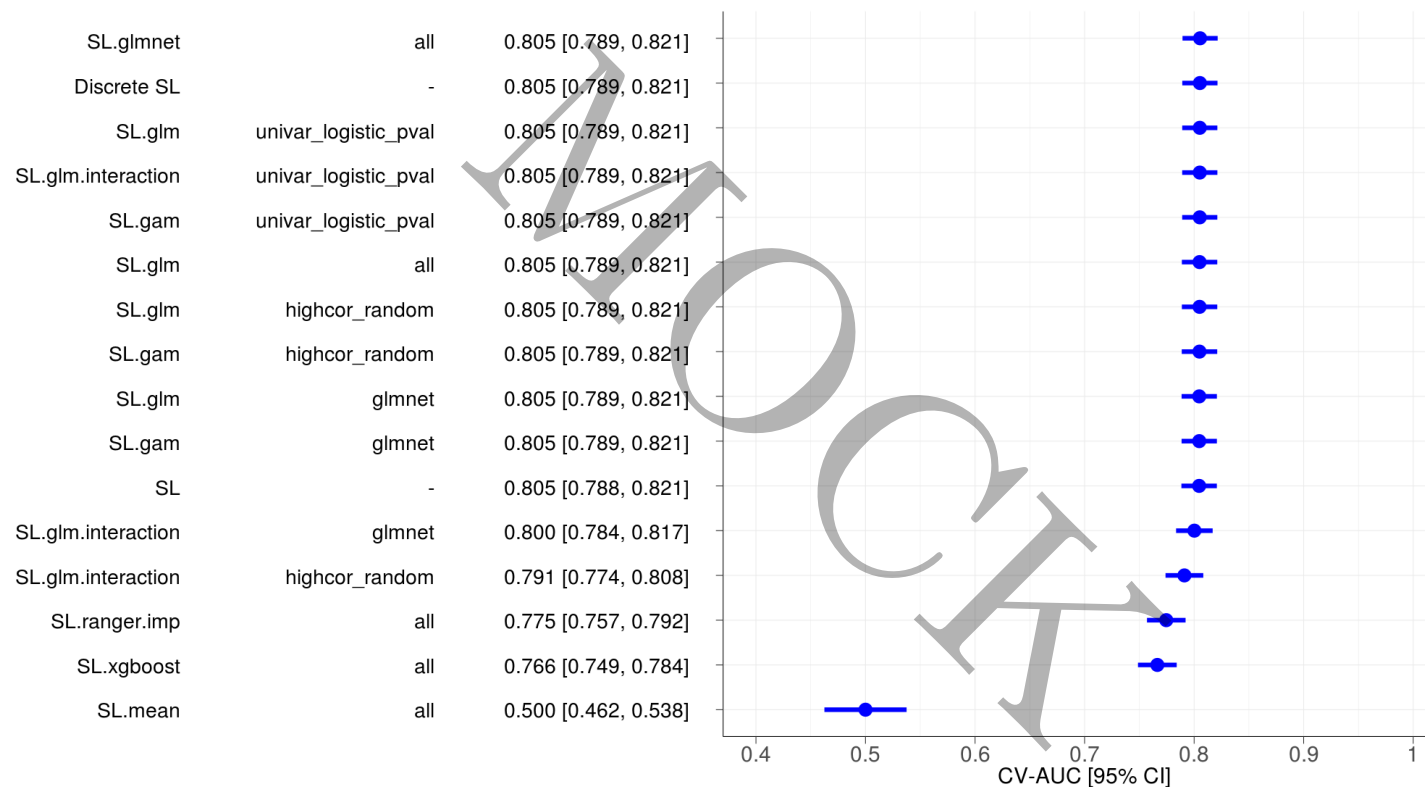


Figure 1.1: Cross-validated AUC (95% CI) of algorithms for predicting COVID-19 disease status starting 7 days after Day 57.

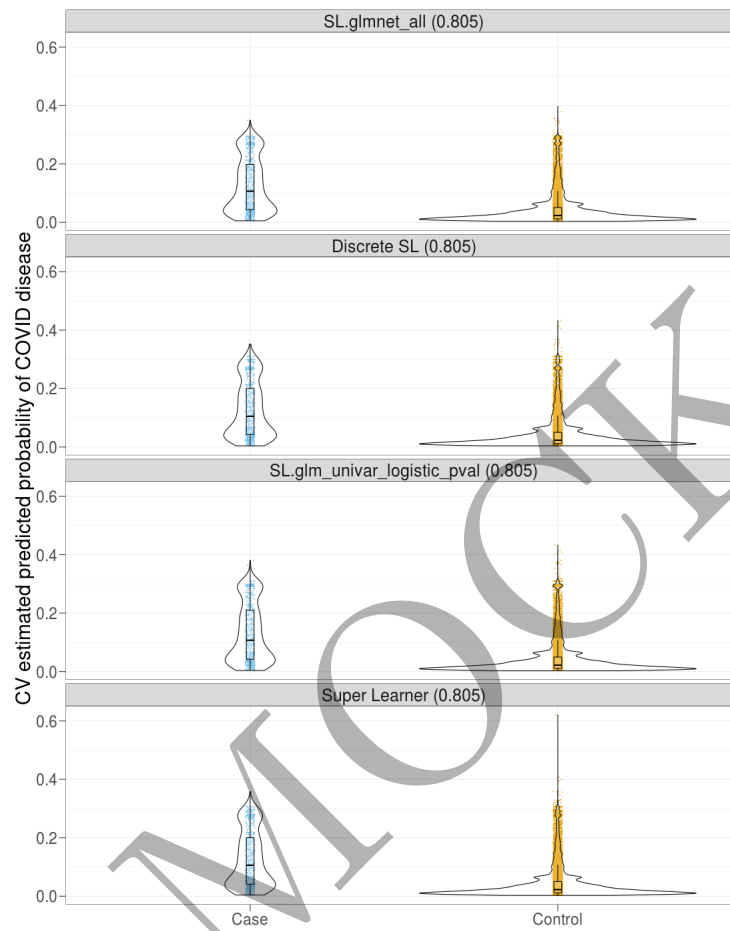


Figure 1.2: CV-estimated predicted probabilities of COVID-19 disease 7 days after Day 57 by case/control status for top 2 learners, SuperLearner and Discrete SL.

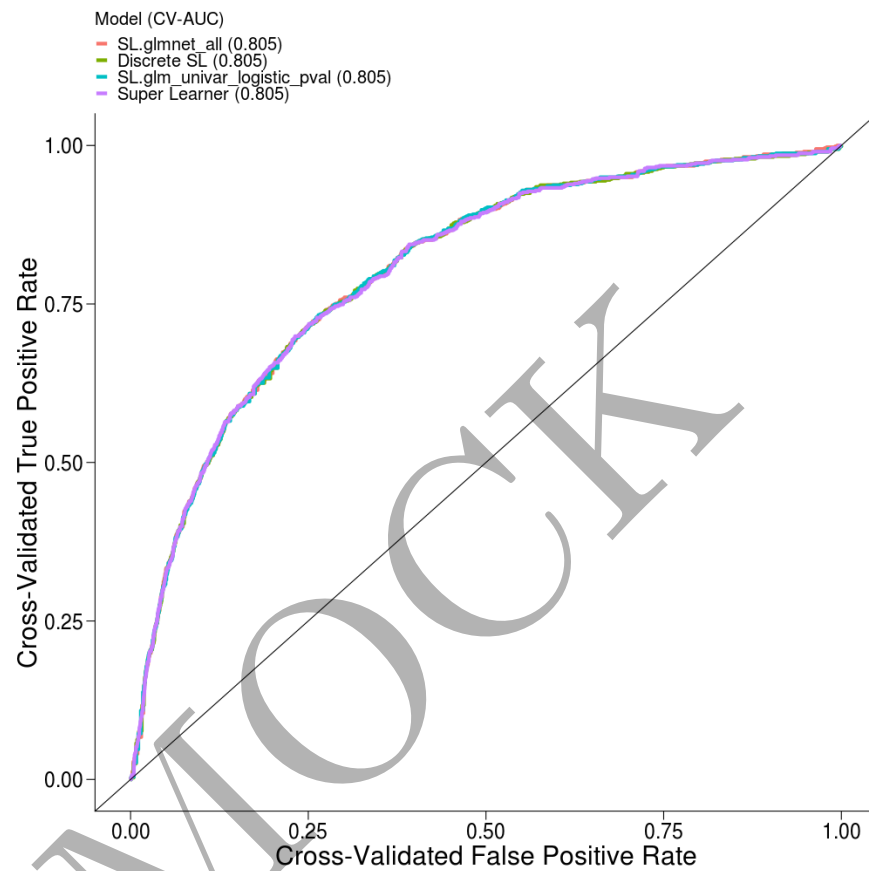


Figure 1.3: ROC curves based off CV-estimated predicted probabilities for the top 2 learners, Superlearner and Discrete SL.

Table 1.3: Weights assigned by Superlearner.

| Learner | Screen | Weight |
|--------------------|---------------------------------|--------|
| SL.glmnet | screen_all | 0.382 |
| SL.glm | screen_all | 0.321 |
| SL.glm.interaction | screen_univariate_logistic_pval | 0.263 |
| SL.glm | screen_univariate_logistic_pval | 0.027 |
| SL.glm.interaction | screen_highcor_random | 0.007 |
| SL.mean | 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_highcor_random | 0.000 |
| SL.glm.interaction | screen_glmnet | 0.000 |
| SL.gam | screen_glmnet | 0.000 |
| SL.gam | screen_univariate_logistic_pval | 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.glmnet | screen_all | 0.382 | (Intercept) | -3.222 | 0.040 |
| SL.glmnet | screen_all | 0.382 | MinorityInd | 0.000 | 1.000 |
| SL.glmnet | screen_all | 0.382 | EthnicityHispanic | 0.000 | 1.000 |
| SL.glmnet | screen_all | 0.382 | EthnicityNotreported | 0.000 | 1.000 |
| SL.glmnet | screen_all | 0.382 | EthnicityUnknown | 0.000 | 1.000 |
| SL.glmnet | screen_all | 0.382 | Black | 0.000 | 1.000 |
| SL.glmnet | screen_all | 0.382 | Asian | 0.000 | 1.000 |
| SL.glmnet | screen_all | 0.382 | NatAmer | 0.000 | 1.000 |
| SL.glmnet | screen_all | 0.382 | PacIsl | 0.000 | 1.000 |
| SL.glmnet | screen_all | 0.382 | Multiracial | 0.000 | 1.000 |
| SL.glmnet | screen_all | 0.382 | Other | 0.000 | 1.000 |
| SL.glmnet | screen_all | 0.382 | Notreported | 0.000 | 1.000 |
| SL.glmnet | screen_all | 0.382 | Unknown | 0.000 | 1.000 |
| SL.glmnet | screen_all | 0.382 | HighRiskInd | 0.553 | 1.739 |
| SL.glmnet | screen_all | 0.382 | Sex | 0.000 | 1.000 |
| SL.glmnet | screen_all | 0.382 | Age | 0.416 | 1.516 |
| SL.glmnet | screen_all | 0.382 | BMI | 0.000 | 1.000 |
| SL.glm | screen_all | 0.321 | (Intercept) | -3.588 | 0.028 |
| SL.glm | screen_all | 0.321 | MinorityInd | -0.082 | 0.922 |
| SL.glm | screen_all | 0.321 | EthnicityHispanic | -0.032 | 0.968 |
| SL.glm | screen_all | 0.321 | EthnicityNotreported | -0.035 | 0.965 |
| SL.glm | screen_all | 0.321 | EthnicityUnknown | 0.031 | 1.032 |
| SL.glm | screen_all | 0.321 | Black | 0.084 | 1.088 |
| SL.glm | screen_all | 0.321 | Asian | 0.100 | 1.105 |
| SL.glm | screen_all | 0.321 | NatAmer | 0.072 | 1.075 |
| SL.glm | screen_all | 0.321 | PacIsl | -0.030 | 0.970 |
| SL.glm | screen_all | 0.321 | Multiracial | 0.015 | 1.015 |
| SL.glm | screen_all | 0.321 | Other | -0.044 | 0.957 |
| SL.glm | screen_all | 0.321 | Notreported | 0.007 | 1.008 |
| SL.glm | screen_all | 0.321 | Unknown | 0.007 | 1.007 |
| SL.glm | screen_all | 0.321 | HighRiskInd | 0.786 | 2.194 |
| SL.glm | screen_all | 0.321 | Sex | 0.013 | 1.013 |
| SL.glm | screen_all | 0.321 | Age | 0.749 | 2.114 |
| SL.glm | screen_all | 0.321 | BMI | 0.001 | 1.001 |
| SL.glm.interaction | screen_univariate_logistic_pval | 0.263 | (Intercept) | -3.610 | 0.027 |
| SL.glm.interaction | screen_univariate_logistic_pval | 0.263 | EthnicityHispanic | -0.076 | 0.926 |
| SL.glm.interaction | screen_univariate_logistic_pval | 0.263 | NatAmer | 0.037 | 1.037 |
| SL.glm.interaction | screen_univariate_logistic_pval | 0.263 | HighRiskInd | 0.813 | 2.255 |
| SL.glm.interaction | screen_univariate_logistic_pval | 0.263 | Age | 0.791 | 2.205 |
| SL.glm.interaction | screen_univariate_logistic_pval | 0.263 | EthnicityHispanic:NatAmer | 0.036 | 1.037 |
| SL.glm.interaction | screen_univariate_logistic_pval | 0.263 | EthnicityHispanic:HighRiskInd | -0.022 | 0.978 |
| SL.glm.interaction | screen_univariate_logistic_pval | 0.263 | EthnicityHispanic:Age | 0.021 | 1.021 |
| SL.glm.interaction | screen_univariate_logistic_pval | 0.263 | NatAmer:HighRiskInd | 0.050 | 1.051 |
| SL.glm.interaction | screen_univariate_logistic_pval | 0.263 | NatAmer:Age | -0.061 | 0.941 |
| SL.glm.interaction | screen_univariate_logistic_pval | 0.263 | HighRiskInd:Age | -0.045 | 0.956 |

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

| Learner | Screen | Weight | Predictors | Coefficient | Odds.Ratio |
|--------------------|---------------------------------|--------|--|-------------|------------|
| SL.glm | screen_univariate_logistic_pval | 0.027 | (Intercept) | -3.581 | 0.028 |
| SL.glm | screen_univariate_logistic_pval | 0.027 | EthnicityHispanic | -0.079 | 0.924 |
| SL.glm | screen_univariate_logistic_pval | 0.027 | NatAmer | 0.050 | 1.051 |
| SL.glm | screen_univariate_logistic_pval | 0.027 | HighRiskInd | 0.785 | 2.193 |
| SL.glm | screen_univariate_logistic_pval | 0.027 | Age | 0.748 | 2.112 |
| SL.glm.interaction | screen_highcor_random | 0.007 | (Intercept) | -4.170 | 0.015 |
| SL.glm.interaction | screen_highcor_random | 0.007 | MinorityInd | -1.038 | 0.354 |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityHispanic | -0.075 | 0.928 |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityNotreported | -0.593 | 0.553 |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityUnknown | -0.410 | 0.663 |
| SL.glm.interaction | screen_highcor_random | 0.007 | Black | 0.567 | 1.762 |
| SL.glm.interaction | screen_highcor_random | 0.007 | Asian | 0.357 | 1.429 |
| SL.glm.interaction | screen_highcor_random | 0.007 | NatAmer | 0.037 | 1.038 |
| SL.glm.interaction | screen_highcor_random | 0.007 | PacIsl | -0.380 | 0.684 |
| SL.glm.interaction | screen_highcor_random | 0.007 | Multiracial | -0.185 | 0.831 |
| SL.glm.interaction | screen_highcor_random | 0.007 | Other | -0.132 | 0.876 |
| SL.glm.interaction | screen_highcor_random | 0.007 | Notreported | -0.976 | 0.377 |
| SL.glm.interaction | screen_highcor_random | 0.007 | Unknown | -0.123 | 0.884 |
| SL.glm.interaction | screen_highcor_random | 0.007 | HighRiskInd | 0.836 | 2.307 |
| SL.glm.interaction | screen_highcor_random | 0.007 | Sex | 0.019 | 1.019 |
| SL.glm.interaction | screen_highcor_random | 0.007 | Age | 0.823 | 2.278 |
| SL.glm.interaction | screen_highcor_random | 0.007 | BMI | 0.123 | 1.131 |
| SL.glm.interaction | screen_highcor_random | 0.007 | MinorityInd:EthnicityHispanic | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | MinorityInd:EthnicityNotreported | -1.379 | 0.252 |
| SL.glm.interaction | screen_highcor_random | 0.007 | MinorityInd:EthnicityUnknown | -1.399 | 0.247 |
| SL.glm.interaction | screen_highcor_random | 0.007 | MinorityInd:Black | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | MinorityInd:Asian | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | MinorityInd:NatAmer | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | MinorityInd:PacIsl | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | MinorityInd:Multiracial | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | MinorityInd:Other | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | MinorityInd:Notreported | -1.376 | 0.253 |
| SL.glm.interaction | screen_highcor_random | 0.007 | MinorityInd:Unknown | 0.084 | 1.088 |
| SL.glm.interaction | screen_highcor_random | 0.007 | MinorityInd:HighRiskInd | -0.087 | 0.916 |
| SL.glm.interaction | screen_highcor_random | 0.007 | MinorityInd:Sex | -0.099 | 0.905 |
| SL.glm.interaction | screen_highcor_random | 0.007 | MinorityInd:Age | 0.136 | 1.146 |
| SL.glm.interaction | screen_highcor_random | 0.007 | MinorityInd:BMI | 0.127 | 1.136 |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityHispanic:EthnicityNotreported | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityHispanic:EthnicityUnknown | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityHispanic:Black | 0.021 | 1.021 |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityHispanic:Asian | -0.091 | 0.913 |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityHispanic:NatAmer | 0.035 | 1.035 |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityHispanic:PacIsl | -0.425 | 0.654 |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityHispanic:Multiracial | 0.044 | 1.044 |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityHispanic:Other | 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 | 0.007 | EthnicityHispanic:Notreported | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityHispanic:Unknown | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityHispanic:HighRiskInd | -0.003 | 0.997 |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityHispanic:Sex | 0.079 | 1.082 |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityHispanic:Age | -0.072 | 0.930 |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityHispanic:BMI | -0.136 | 0.873 |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityNotreported:EthnicityUnknown | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityNotreported:Black | 1.042 | 2.836 |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityNotreported:Asian | 0.600 | 1.822 |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityNotreported:NatAmer | -0.063 | 0.939 |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityNotreported:PacIsl | 0.053 | 1.054 |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityNotreported:Multiracial | -0.041 | 0.960 |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityNotreported:Other | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityNotreported:Notreported | -0.022 | 0.978 |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityNotreported:Unknown | -0.426 | 0.653 |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityNotreported:HighRiskInd | 0.091 | 1.095 |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityNotreported:Sex | -0.022 | 0.978 |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityNotreported:Age | 0.013 | 1.013 |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityNotreported:BMI | -0.005 | 0.995 |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityUnknown:Black | 1.018 | 2.767 |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityUnknown:Asian | 0.645 | 1.907 |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityUnknown:NatAmer | -0.021 | 0.979 |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityUnknown:PacIsl | -0.030 | 0.971 |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityUnknown:Multiracial | 0.075 | 1.078 |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityUnknown:Other | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityUnknown:Notreported | -0.085 | 0.918 |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityUnknown:Unknown | -0.411 | 0.663 |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityUnknown:HighRiskInd | 0.024 | 1.024 |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityUnknown:Sex | 0.035 | 1.036 |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityUnknown:Age | -0.033 | 0.967 |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityUnknown:BMI | -0.018 | 0.982 |
| SL.glm.interaction | screen_highcor_random | 0.007 | Black:Asian | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | Black:NatAmer | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | Black:PacIsl | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | Black:Multiracial | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | Black:Other | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | Black:Notreported | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | Black:Unknown | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | Black:HighRiskInd | 0.045 | 1.046 |
| SL.glm.interaction | screen_highcor_random | 0.007 | Black:Sex | 0.041 | 1.042 |
| SL.glm.interaction | screen_highcor_random | 0.007 | Black:Age | -0.085 | 0.919 |
| SL.glm.interaction | screen_highcor_random | 0.007 | Black:BMI | -0.060 | 0.942 |
| SL.glm.interaction | screen_highcor_random | 0.007 | Asian:NatAmer | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | Asian:PacIsl | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | Asian: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 | 0.007 | Asian:Other | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | Asian:Notreported | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | Asian:Unknown | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | Asian:HighRiskInd | 0.039 | 1.040 |
| SL.glm.interaction | screen_highcor_random | 0.007 | Asian:Sex | 0.005 | 1.005 |
| SL.glm.interaction | screen_highcor_random | 0.007 | Asian:Age | -0.023 | 0.977 |
| SL.glm.interaction | screen_highcor_random | 0.007 | Asian:BMI | -0.129 | 0.879 |
| SL.glm.interaction | screen_highcor_random | 0.007 | NatAmer:PacIsl | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | NatAmer:Multiracial | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | NatAmer:Other | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | NatAmer:Notreported | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | NatAmer:Unknown | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | NatAmer:HighRiskInd | 0.078 | 1.081 |
| SL.glm.interaction | screen_highcor_random | 0.007 | NatAmer:Sex | -0.010 | 0.990 |
| SL.glm.interaction | screen_highcor_random | 0.007 | NatAmer:Age | -0.098 | 0.907 |
| SL.glm.interaction | screen_highcor_random | 0.007 | NatAmer:BMI | -0.045 | 0.956 |
| SL.glm.interaction | screen_highcor_random | 0.007 | PacIsl:Multiracial | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | PacIsl:Other | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | PacIsl:Notreported | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | PacIsl:Unknown | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | PacIsl:HighRiskInd | 0.070 | 1.073 |
| SL.glm.interaction | screen_highcor_random | 0.007 | PacIsl:Sex | -0.044 | 0.957 |
| SL.glm.interaction | screen_highcor_random | 0.007 | PacIsl:Age | 0.120 | 1.128 |
| SL.glm.interaction | screen_highcor_random | 0.007 | PacIsl:BMI | -0.075 | 0.928 |
| SL.glm.interaction | screen_highcor_random | 0.007 | Multiracial:Other | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | Multiracial:Notreported | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | Multiracial:Unknown | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | Multiracial:HighRiskInd | 0.079 | 1.083 |
| SL.glm.interaction | screen_highcor_random | 0.007 | Multiracial:Sex | 0.001 | 1.001 |
| SL.glm.interaction | screen_highcor_random | 0.007 | Multiracial:Age | 0.029 | 1.030 |
| SL.glm.interaction | screen_highcor_random | 0.007 | Multiracial:BMI | 0.111 | 1.118 |
| SL.glm.interaction | screen_highcor_random | 0.007 | Other:Notreported | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | Other:Unknown | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | Other:HighRiskInd | 0.031 | 1.032 |
| SL.glm.interaction | screen_highcor_random | 0.007 | Other:Sex | -0.035 | 0.966 |
| SL.glm.interaction | screen_highcor_random | 0.007 | Other:Age | 0.055 | 1.056 |
| SL.glm.interaction | screen_highcor_random | 0.007 | Other:BMI | -0.026 | 0.975 |
| SL.glm.interaction | screen_highcor_random | 0.007 | Notreported:Unknown | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | Notreported:HighRiskInd | 0.028 | 1.028 |
| SL.glm.interaction | screen_highcor_random | 0.007 | Notreported:Sex | 0.011 | 1.011 |
| SL.glm.interaction | screen_highcor_random | 0.007 | Notreported:Age | 0.014 | 1.014 |
| SL.glm.interaction | screen_highcor_random | 0.007 | Notreported:BMI | 0.033 | 1.034 |
| SL.glm.interaction | screen_highcor_random | 0.007 | Unknown:HighRiskInd | -0.033 | 0.967 |
| SL.glm.interaction | screen_highcor_random | 0.007 | Unknown:Sex | -0.058 | 0.944 |
| SL.glm.interaction | screen_highcor_random | 0.007 | Unknown:Age | -0.008 | 0.992 |

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 | 0.007 | Unknown:BMI | 0.043 | 1.044 |
| SL.glm.interaction | screen_highcor_random | 0.007 | HighRiskInd:Sex | -0.031 | 0.969 |
| SL.glm.interaction | screen_highcor_random | 0.007 | HighRiskInd:Age | -0.052 | 0.949 |
| SL.glm.interaction | screen_highcor_random | 0.007 | HighRiskInd:BMI | -0.096 | 0.909 |
| SL.glm.interaction | screen_highcor_random | 0.007 | Sex:Age | 0.037 | 1.037 |
| SL.glm.interaction | screen_highcor_random | 0.007 | Sex:BMI | 0.001 | 1.001 |
| SL.glm.interaction | screen_highcor_random | 0.007 | Age:BMI | -0.049 | 0.952 |
| SL.glm.interaction | screen_highcor_random | 0.007 | (Intercept) | -4.170 | 0.015 |
| SL.glm.interaction | screen_highcor_random | 0.007 | MinorityInd | -1.038 | 0.354 |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityHispanic | -0.075 | 0.928 |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityNotreported | -0.593 | 0.553 |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityUnknown | -0.410 | 0.663 |
| SL.glm.interaction | screen_highcor_random | 0.007 | Black | 0.567 | 1.762 |
| SL.glm.interaction | screen_highcor_random | 0.007 | Asian | 0.357 | 1.429 |
| SL.glm.interaction | screen_highcor_random | 0.007 | NatAmer | 0.037 | 1.038 |
| SL.glm.interaction | screen_highcor_random | 0.007 | PacIsl | -0.380 | 0.684 |
| SL.glm.interaction | screen_highcor_random | 0.007 | Multiracial | -0.185 | 0.831 |
| SL.glm.interaction | screen_highcor_random | 0.007 | Other | -0.132 | 0.876 |
| SL.glm.interaction | screen_highcor_random | 0.007 | Notreported | -0.976 | 0.377 |
| SL.glm.interaction | screen_highcor_random | 0.007 | Unknown | -0.123 | 0.884 |
| SL.glm.interaction | screen_highcor_random | 0.007 | HighRiskInd | 0.836 | 2.307 |
| SL.glm.interaction | screen_highcor_random | 0.007 | Sex | 0.019 | 1.019 |
| SL.glm.interaction | screen_highcor_random | 0.007 | Age | 0.823 | 2.278 |
| SL.glm.interaction | screen_highcor_random | 0.007 | BMI | 0.123 | 1.131 |
| SL.glm.interaction | screen_highcor_random | 0.007 | MinorityInd:EthnicityHispanic | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | MinorityInd:EthnicityNotreported | -1.379 | 0.252 |
| SL.glm.interaction | screen_highcor_random | 0.007 | MinorityInd:EthnicityUnknown | -1.399 | 0.247 |
| SL.glm.interaction | screen_highcor_random | 0.007 | MinorityInd:Black | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | MinorityInd:Asian | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | MinorityInd:NatAmer | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | MinorityInd:PacIsl | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | MinorityInd:Multiracial | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | MinorityInd:Other | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | MinorityInd:Notreported | -1.376 | 0.253 |
| SL.glm.interaction | screen_highcor_random | 0.007 | MinorityInd:Unknown | 0.084 | 1.088 |
| SL.glm.interaction | screen_highcor_random | 0.007 | MinorityInd:HighRiskInd | -0.087 | 0.916 |
| SL.glm.interaction | screen_highcor_random | 0.007 | MinorityInd:Sex | -0.099 | 0.905 |
| SL.glm.interaction | screen_highcor_random | 0.007 | MinorityInd:Age | 0.136 | 1.146 |
| SL.glm.interaction | screen_highcor_random | 0.007 | MinorityInd:BMI | 0.127 | 1.136 |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityHispanic:EthnicityNotreported | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityHispanic:EthnicityUnknown | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityHispanic:Black | 0.021 | 1.021 |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityHispanic:Asian | -0.091 | 0.913 |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityHispanic:NatAmer | 0.035 | 1.035 |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityHispanic:PacIsl | -0.425 | 0.654 |

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 | 0.007 | EthnicityHispanic:Multiracial | 0.044 | 1.044 |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityHispanic:Other | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityHispanic:Notreported | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityHispanic:Unknown | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityHispanic:HighRiskInd | -0.003 | 0.997 |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityHispanic:Sex | 0.079 | 1.082 |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityHispanic:Age | -0.072 | 0.930 |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityHispanic:BMI | -0.136 | 0.873 |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityNotreported:EthnicityUnknown | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityNotreported:Black | 1.042 | 2.836 |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityNotreported:Asian | 0.600 | 1.822 |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityNotreported:NatAmer | -0.063 | 0.939 |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityNotreported:PacIsl | 0.053 | 1.054 |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityNotreported:Multiracial | -0.041 | 0.960 |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityNotreported:Other | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityNotreported:Notreported | -0.022 | 0.978 |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityNotreported:Unknown | -0.426 | 0.653 |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityNotreported:HighRiskInd | 0.091 | 1.095 |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityNotreported:Sex | -0.022 | 0.978 |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityNotreported:Age | 0.013 | 1.013 |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityNotreported:BMI | -0.005 | 0.995 |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityUnknown:Black | 1.018 | 2.767 |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityUnknown:Asian | 0.645 | 1.907 |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityUnknown:NatAmer | -0.021 | 0.979 |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityUnknown:PacIsl | -0.030 | 0.971 |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityUnknown:Multiracial | 0.075 | 1.078 |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityUnknown:Other | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityUnknown:Notreported | -0.085 | 0.918 |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityUnknown:Unknown | -0.411 | 0.663 |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityUnknown:HighRiskInd | 0.024 | 1.024 |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityUnknown:Sex | 0.035 | 1.036 |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityUnknown:Age | -0.033 | 0.967 |
| SL.glm.interaction | screen_highcor_random | 0.007 | EthnicityUnknown:BMI | -0.018 | 0.982 |
| SL.glm.interaction | screen_highcor_random | 0.007 | Black:Asian | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | Black:NatAmer | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | Black:PacIsl | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | Black:Multiracial | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | Black:Other | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | Black:Notreported | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | Black:Unknown | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | Black:HighRiskInd | 0.045 | 1.046 |
| SL.glm.interaction | screen_highcor_random | 0.007 | Black:Sex | 0.041 | 1.042 |
| SL.glm.interaction | screen_highcor_random | 0.007 | Black:Age | -0.085 | 0.919 |
| SL.glm.interaction | screen_highcor_random | 0.007 | Black:BMI | -0.060 | 0.942 |
| SL.glm.interaction | screen_highcor_random | 0.007 | Asian: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 | 0.007 | Asian:PacIsl | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | Asian:Multiracial | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | Asian:Other | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | Asian:Notreported | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | Asian:Unknown | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | Asian:HighRiskInd | 0.039 | 1.040 |
| SL.glm.interaction | screen_highcor_random | 0.007 | Asian:Sex | 0.005 | 1.005 |
| SL.glm.interaction | screen_highcor_random | 0.007 | Asian:Age | -0.023 | 0.977 |
| SL.glm.interaction | screen_highcor_random | 0.007 | Asian:BMI | -0.129 | 0.879 |
| SL.glm.interaction | screen_highcor_random | 0.007 | NatAmer:PacIsl | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | NatAmer:Multiracial | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | NatAmer:Other | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | NatAmer:Notreported | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | NatAmer:Unknown | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | NatAmer:HighRiskInd | 0.078 | 1.081 |
| SL.glm.interaction | screen_highcor_random | 0.007 | NatAmer:Sex | -0.010 | 0.990 |
| SL.glm.interaction | screen_highcor_random | 0.007 | NatAmer:Age | -0.098 | 0.907 |
| SL.glm.interaction | screen_highcor_random | 0.007 | NatAmer:BMI | -0.045 | 0.956 |
| SL.glm.interaction | screen_highcor_random | 0.007 | PacIsl:Multiracial | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | PacIsl:Other | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | PacIsl:Notreported | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | PacIsl:Unknown | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | PacIsl:HighRiskInd | 0.070 | 1.073 |
| SL.glm.interaction | screen_highcor_random | 0.007 | PacIsl:Sex | -0.044 | 0.957 |
| SL.glm.interaction | screen_highcor_random | 0.007 | PacIsl:Age | 0.120 | 1.128 |
| SL.glm.interaction | screen_highcor_random | 0.007 | PacIsl:BMI | -0.075 | 0.928 |
| SL.glm.interaction | screen_highcor_random | 0.007 | Multiracial:Other | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | Multiracial:Notreported | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | Multiracial:Unknown | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | Multiracial:HighRiskInd | 0.079 | 1.083 |
| SL.glm.interaction | screen_highcor_random | 0.007 | Multiracial:Sex | 0.001 | 1.001 |
| SL.glm.interaction | screen_highcor_random | 0.007 | Multiracial:Age | 0.029 | 1.030 |
| SL.glm.interaction | screen_highcor_random | 0.007 | Multiracial:BMI | 0.111 | 1.118 |
| SL.glm.interaction | screen_highcor_random | 0.007 | Other:Notreported | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | Other:Unknown | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | Other:HighRiskInd | 0.031 | 1.032 |
| SL.glm.interaction | screen_highcor_random | 0.007 | Other:Sex | -0.035 | 0.966 |
| SL.glm.interaction | screen_highcor_random | 0.007 | Other:Age | 0.055 | 1.056 |
| SL.glm.interaction | screen_highcor_random | 0.007 | Other:BMI | -0.026 | 0.975 |
| SL.glm.interaction | screen_highcor_random | 0.007 | Notreported:Unknown | NA | NA |
| SL.glm.interaction | screen_highcor_random | 0.007 | Notreported:HighRiskInd | 0.028 | 1.028 |
| SL.glm.interaction | screen_highcor_random | 0.007 | Notreported:Sex | 0.011 | 1.011 |
| SL.glm.interaction | screen_highcor_random | 0.007 | Notreported:Age | 0.014 | 1.014 |
| SL.glm.interaction | screen_highcor_random | 0.007 | Notreported:BMI | 0.033 | 1.034 |
| SL.glm.interaction | screen_highcor_random | 0.007 | Unknown:HighRiskInd | -0.033 | 0.967 |

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 | 0.007 | Unknown:Sex | -0.058 | 0.944 |
| SL.glm.interaction | screen_highcor_random | 0.007 | Unknown:Age | -0.008 | 0.992 |
| SL.glm.interaction | screen_highcor_random | 0.007 | Unknown:BMI | 0.043 | 1.044 |
| SL.glm.interaction | screen_highcor_random | 0.007 | HighRiskInd:Sex | -0.031 | 0.969 |
| SL.glm.interaction | screen_highcor_random | 0.007 | HighRiskInd:Age | -0.052 | 0.949 |
| SL.glm.interaction | screen_highcor_random | 0.007 | HighRiskInd:BMI | -0.096 | 0.909 |
| SL.glm.interaction | screen_highcor_random | 0.007 | Sex:Age | 0.037 | 1.037 |
| SL.glm.interaction | screen_highcor_random | 0.007 | Sex:BMI | 0.001 | 1.001 |
| SL.glm.interaction | screen_highcor_random | 0.007 | Age:BMI | -0.049 | 0.952 |

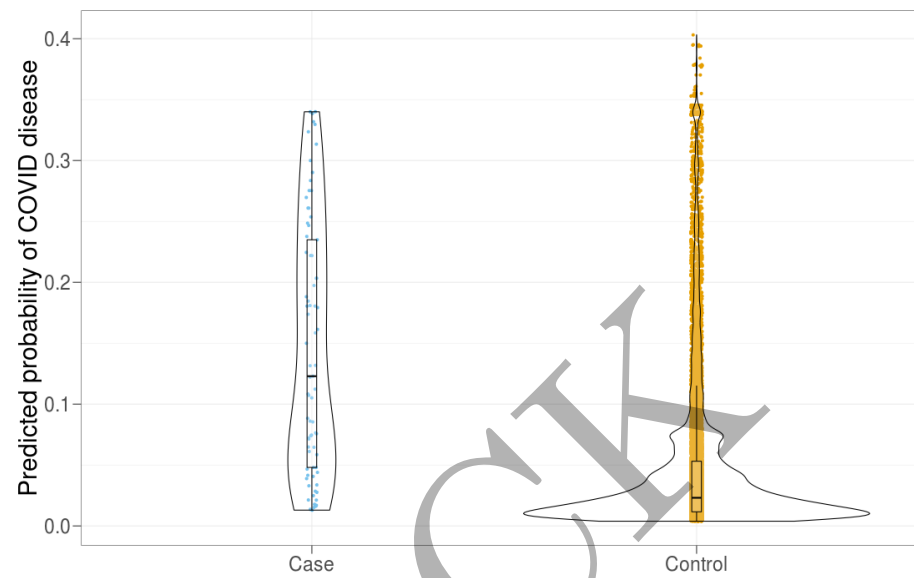


Figure 1.4: Superlearner predicted probabilities of COVID-19 disease in vaccinees 7 days after Day 57 by case/control status.

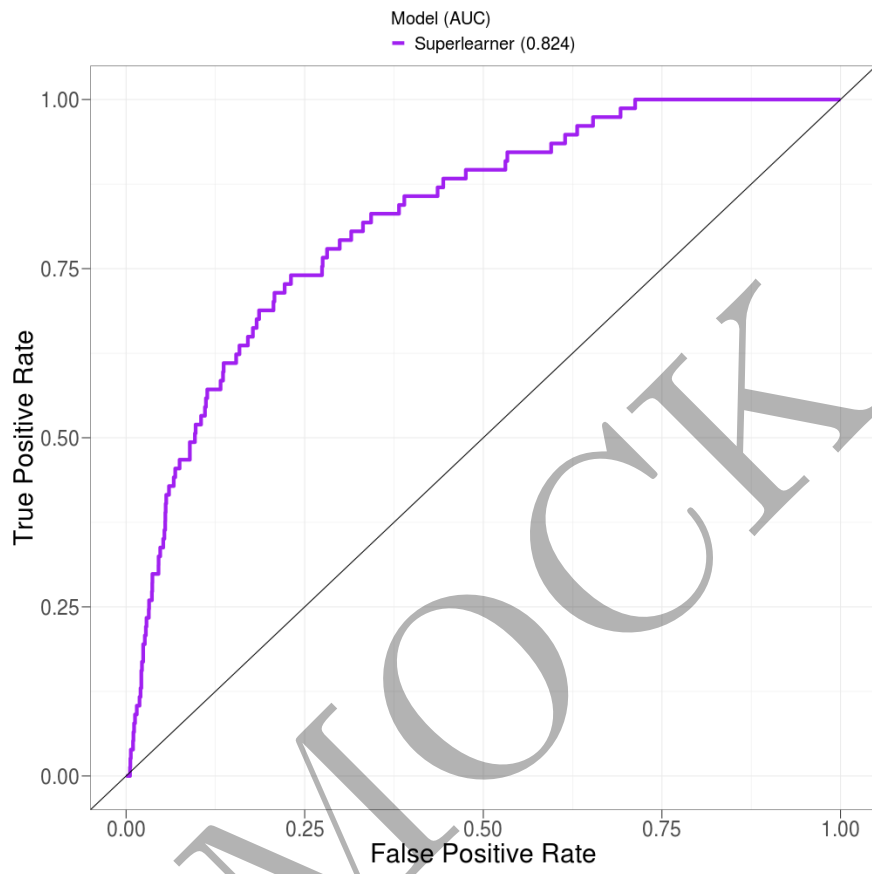


Figure 1.5: ROC curve based off Superlearner predicted probabilities in vaccinees.

MOCK

Chapter 2

Appendix

- This report was built from the [CoVPN/correlates_reporting](https://github.com/CoVPN/correlates_reporting/commit/99ab2f3d493638d6ecc8f889ad3784061d3e4b5b) repository with commit hash 99ab2f3d493638d6ecc8f889ad3784061d3e4b5b. A diff of the changes introduced by that commit may be viewed at https://github.com/CoVPN/correlates_reporting/commit/99ab2f3d493638d6ecc8f889ad3784061d3e4b5b
- The sha256 hash sum of the raw input file, “COVID_VEtrial_practicedata_primarystage1.csv”:
b91bb45a990c435d4630dea29b63b768f7edb40d9306f6bc108486a780166fd4
- The sha256 hash sum of the processed file, “practice_data.csv”:
8f997ce8665b05dfd7da7688a91439ff6e31df7a343b7b975fbf162169ba41a1