COVID-19 Baseline Risk Score Analysis Report

MockCOVE Study

USG COVID-19 Response Biostatistics Team

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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.

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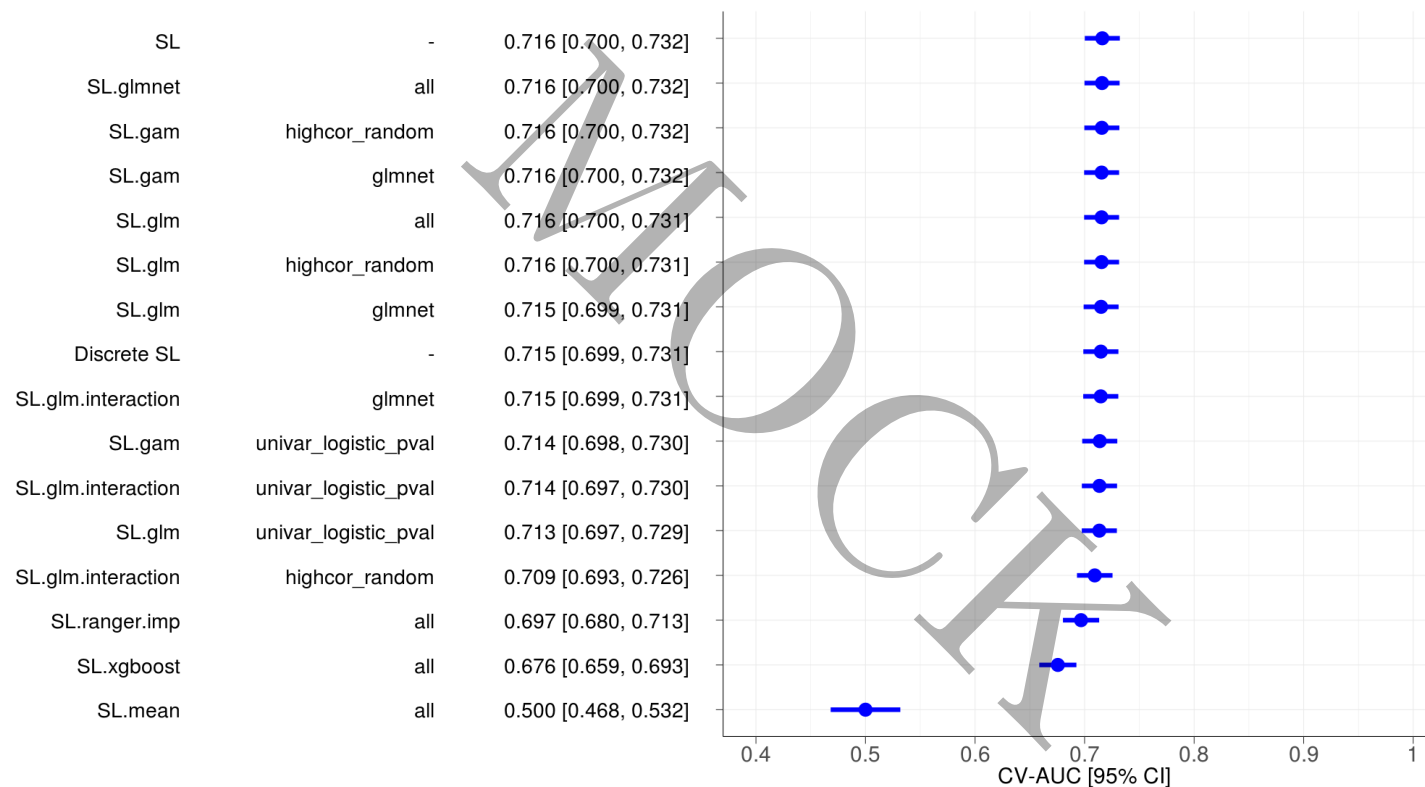
Figure 2.1: Cross-validated AUC (95% CI) of algorithms for predicting COVID-19 disease status starting 7 days after Day 57.

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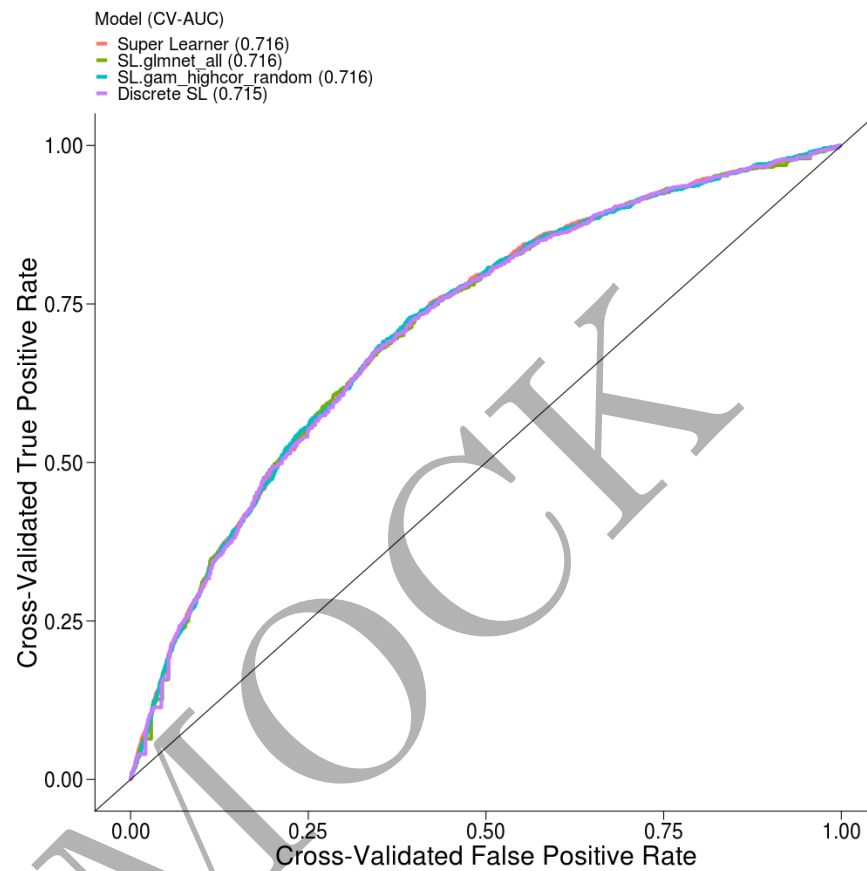
Figure 2.3: ROC curves based off CV-estimated predicted probabilities for the top 2 learners, Superlearner and Discrete SL.

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.
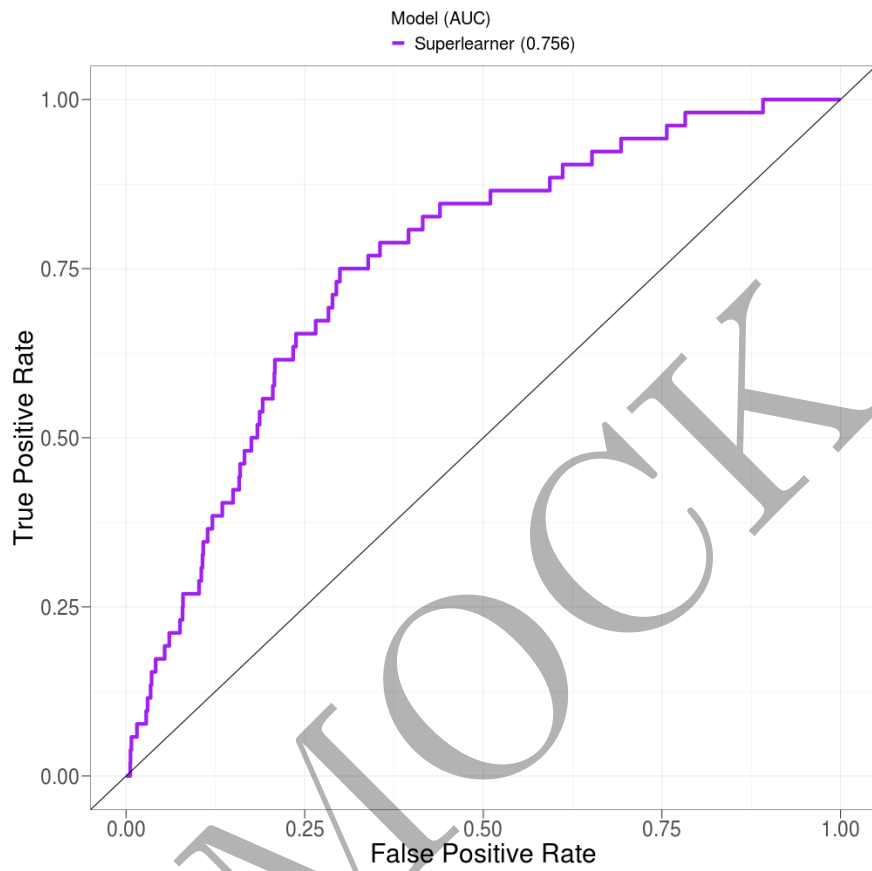
Figure 2.5: ROC curve based off Superlearner predicted probabilities in vacci-
nees.

Chapter 3

Appendix

- This report was built from the `CoVPN/correlates_reporting` repository with commit hash 8235382fa9f82b5c9a30b7060661fda385c44dd3. A diff of the changes introduced by that commit may be viewed at https://github.com/CoVPN/correlates_reporting/commit/8235382fa9f82b5c9a30b7060661fda385c44dd3

- 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": 28964ce20cfcd70a621aff9df412c42b1178d5e749e0f49ddd79fbff2dc7c90a