

# COVID-19 Baseline Risk Score Analysis Report

mock Study

USG COVID-19 Response Biostatistics Team

May 18, 2021



# Contents

<b>1</b>	<b>Baseline Risk Score (Proxy for SARS-CoV-2 Exposure)</b>	<b>9</b>
<b>2</b>	<b>Appendix</b>	<b>21</b>



# List of Tables

- 1.1 Variables considered for risk score analysis. . . . . 10
- 1.2 All learner-screen combinations (28 in total) used as input to the  
Superlearner. . . . . 11
- 1.3 Weights assigned by Superlearner. . . . . 15
- 1.4 Predictors in learners assigned weight  $> 0.0$  by Superlearner. . . 16



# List of Figures

1.1	Cross-validated AUC (95% CI) of algorithms for predicting COVID-19 disease status starting 7 days after Day 57. . . . .	12
1.2	CV-estimated predicted probabilities of COVID-19 disease 7 days after Day 57 by case/control status for top 2 learners, Super-Learner and Discrete SL. . . . .	13
1.3	ROC curves based off CV-estimated predicted probabilities for the top 2 learners, Superlearner and Discrete SL. . . . .	14
1.4	Superlearner predicted probabilities of COVID-19 disease in vaccinees 7 days after Day 57 by case/control status. . . . .	18
1.5	ROC curve based off Superlearner predicted probabilities in vaccinees. . . . .	19

MOCK



## 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 ( $\text{kg}/\text{m}^2$ )	0/30000 (0.0%)	NA

Table 1.2: All learner-screen combinations (28 in total) used as input to the Superlearner.

<b>Learner</b>	<b>Screen*</b>
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.

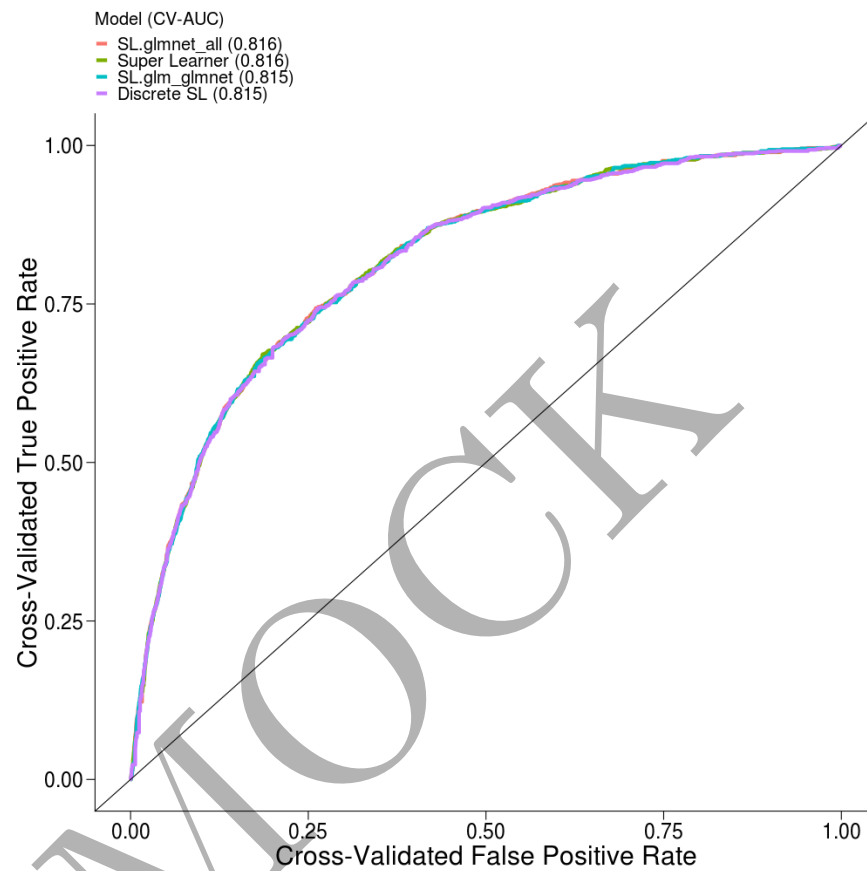


Figure 1.3: ROC curves based off CV-estimated predicted probabilities for the top 2 learners, Superlearner and Discrete SL.

Table 1.3: Weights assigned by Superlearner.

Learner	Screen	Weight
SL.glmnet	screen_all	0.654
SL.ranger.imp	screen_all	0.125
SL.glm	screen_glmnet	0.098
SL.glm	screen_univariate_logistic_pval	0.066
SL.glm	screen_all	0.057
SL.mean	screen_all	0.000
SL.xgboost	screen_all	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.glm.interaction	screen_highcor_random	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 &gt; 0.0 by Superlearner.

Learner	Screen	Weight	Predictors	Coefficient	Odds.Ratio	Importance
SL.glmnet	screen_all	0.654	(Intercept)	-2.868	0.057	NA
SL.glmnet	screen_all	0.654	MinorityInd	0.000	1.000	NA
SL.glmnet	screen_all	0.654	EthnicityHispanic	0.000	1.000	NA
SL.glmnet	screen_all	0.654	EthnicityNotreported	0.000	1.000	NA
SL.glmnet	screen_all	0.654	EthnicityUnknown	0.000	1.000	NA
SL.glmnet	screen_all	0.654	Black	0.000	1.000	NA
SL.glmnet	screen_all	0.654	Asian	0.000	1.000	NA
SL.glmnet	screen_all	0.654	NatAmer	0.000	1.000	NA
SL.glmnet	screen_all	0.654	PacIsl	0.000	1.000	NA
SL.glmnet	screen_all	0.654	Multiracial	0.000	1.000	NA
SL.glmnet	screen_all	0.654	Other	0.000	1.000	NA
SL.glmnet	screen_all	0.654	Notreported	0.000	1.000	NA
SL.glmnet	screen_all	0.654	Unknown	0.000	1.000	NA
SL.glmnet	screen_all	0.654	HighRiskInd	0.615	1.850	NA
SL.glmnet	screen_all	0.654	Sex	0.000	1.000	NA
SL.glmnet	screen_all	0.654	Age	0.431	1.539	NA
SL.glmnet	screen_all	0.654	BMI	0.000	1.000	NA
SL.ranger.imp	screen_all	0.125	MinorityInd	NA	NA	11.065
SL.ranger.imp	screen_all	0.125	EthnicityHispanic	NA	NA	10.195
SL.ranger.imp	screen_all	0.125	EthnicityNotreported	NA	NA	11.820
SL.ranger.imp	screen_all	0.125	EthnicityUnknown	NA	NA	9.214
SL.ranger.imp	screen_all	0.125	Black	NA	NA	10.111
SL.ranger.imp	screen_all	0.125	Asian	NA	NA	8.396
SL.ranger.imp	screen_all	0.125	NatAmer	NA	NA	5.002
SL.ranger.imp	screen_all	0.125	PacIsl	NA	NA	4.260
SL.ranger.imp	screen_all	0.125	Multiracial	NA	NA	7.162
SL.ranger.imp	screen_all	0.125	Other	NA	NA	4.091
SL.ranger.imp	screen_all	0.125	Notreported	NA	NA	9.353
SL.ranger.imp	screen_all	0.125	Unknown	NA	NA	4.914
SL.ranger.imp	screen_all	0.125	HighRiskInd	NA	NA	144.498
SL.ranger.imp	screen_all	0.125	Sex	NA	NA	16.469
SL.ranger.imp	screen_all	0.125	Age	NA	NA	198.616
SL.ranger.imp	screen_all	0.125	BMI	NA	NA	221.076
SL.glm	screen_glmnet	0.098	(Intercept)	-3.234	0.039	NA
SL.glm	screen_glmnet	0.098	MinorityInd	-0.044	0.957	NA
SL.glm	screen_glmnet	0.098	Other	-0.089	0.914	NA
SL.glm	screen_glmnet	0.098	Notreported	0.036	1.036	NA
SL.glm	screen_glmnet	0.098	HighRiskInd	0.862	2.367	NA
SL.glm	screen_glmnet	0.098	Sex	0.080	1.084	NA
SL.glm	screen_glmnet	0.098	Age	0.763	2.145	NA
SL.glm	screen_glmnet	0.098	BMI	-0.047	0.954	NA
SL.glm	screen_univariate_logistic_pval	0.066	(Intercept)	-3.232	0.039	NA
SL.glm	screen_univariate_logistic_pval	0.066	Other	-0.099	0.906	NA
SL.glm	screen_univariate_logistic_pval	0.066	HighRiskInd	0.861	2.366	NA
SL.glm	screen_univariate_logistic_pval	0.066	Sex	0.080	1.083	NA



Table 1.4: Predictors in learners assigned weight &gt; 0.0 by Superlearner. (continued)

Learner	Screen	Weight	Predictors	Coefficient	Odds.Ratio	Importance
SL.glm	screen_univariate_logistic_pval	0.066	Age	0.763	2.144	NA
SL.glm	screen_all	0.057	(Intercept)	-3.236	0.039	NA
SL.glm	screen_all	0.057	MinorityInd	-0.102	0.903	NA
SL.glm	screen_all	0.057	EthnicityHispanic	0.060	1.062	NA
SL.glm	screen_all	0.057	EthnicityNotreported	0.018	1.018	NA
SL.glm	screen_all	0.057	EthnicityUnknown	-0.022	0.978	NA
SL.glm	screen_all	0.057	Black	0.023	1.023	NA
SL.glm	screen_all	0.057	Asian	0.025	1.025	NA
SL.glm	screen_all	0.057	NatAmer	-0.013	0.987	NA
SL.glm	screen_all	0.057	PacIsl	0.018	1.018	NA
SL.glm	screen_all	0.057	Multiracial	0.022	1.022	NA
SL.glm	screen_all	0.057	Other	-0.091	0.913	NA
SL.glm	screen_all	0.057	Notreported	0.036	1.037	NA
SL.glm	screen_all	0.057	Unknown	0.027	1.027	NA
SL.glm	screen_all	0.057	HighRiskInd	0.862	2.368	NA
SL.glm	screen_all	0.057	Sex	0.080	1.084	NA
SL.glm	screen_all	0.057	Age	0.765	2.149	NA
SL.glm	screen_all	0.057	BMI	-0.047	0.954	NA
SL.glm	screen_all	0.057	(Intercept)	-3.236	0.039	NA
SL.glm	screen_all	0.057	MinorityInd	-0.102	0.903	NA
SL.glm	screen_all	0.057	EthnicityHispanic	0.060	1.062	NA
SL.glm	screen_all	0.057	EthnicityNotreported	0.018	1.018	NA
SL.glm	screen_all	0.057	EthnicityUnknown	-0.022	0.978	NA
SL.glm	screen_all	0.057	Black	0.023	1.023	NA
SL.glm	screen_all	0.057	Asian	0.025	1.025	NA
SL.glm	screen_all	0.057	NatAmer	-0.013	0.987	NA
SL.glm	screen_all	0.057	PacIsl	0.018	1.018	NA
SL.glm	screen_all	0.057	Multiracial	0.022	1.022	NA
SL.glm	screen_all	0.057	Other	-0.091	0.913	NA
SL.glm	screen_all	0.057	Notreported	0.036	1.037	NA
SL.glm	screen_all	0.057	Unknown	0.027	1.027	NA
SL.glm	screen_all	0.057	HighRiskInd	0.862	2.368	NA
SL.glm	screen_all	0.057	Sex	0.080	1.084	NA
SL.glm	screen_all	0.057	Age	0.765	2.149	NA
SL.glm	screen_all	0.057	BMI	-0.047	0.954	NA



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) repository with commit hash 039420088df38a9c8be48c39d226ff7b7ef46e04. A diff of the changes introduced by that commit may be viewed at [https://github.com/CoVPN/correlates\\_reporting/commit/039420088df38a9c8be48c39d226ff7b7ef46e04](https://github.com/CoVPN/correlates_reporting/commit/039420088df38a9c8be48c39d226ff7b7ef46e04)
- The sha256 hash sum of the raw input file, “COVID\_VEtrial\_practicedata\_primarystage1.csv”:  
45ff85033ffbc717462d678b41bc4060a12c7bc60952e2cb72297bb5500b97b9
- The sha256 hash sum of the processed file, “practice\_data.csv”:  
aaf466d62ce6f25c7c8cd2adfdb6805ad3cb140a363f3cb4b9a9aeca8592eab8