ds2_midterm

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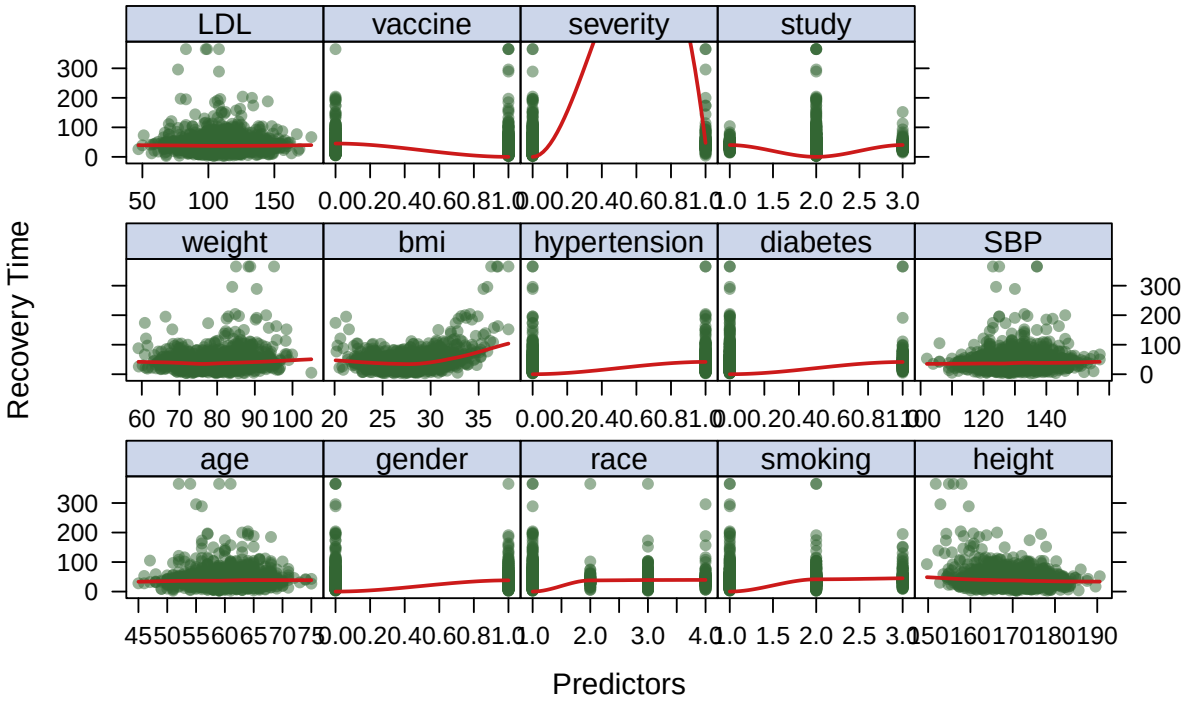
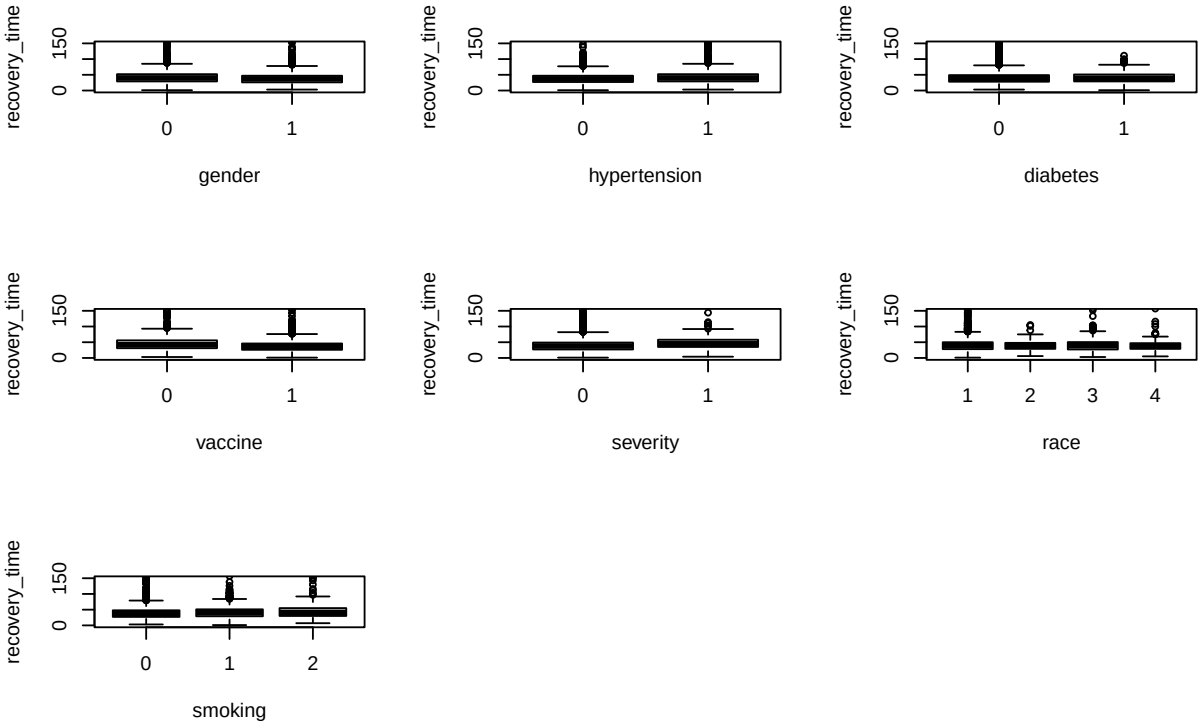
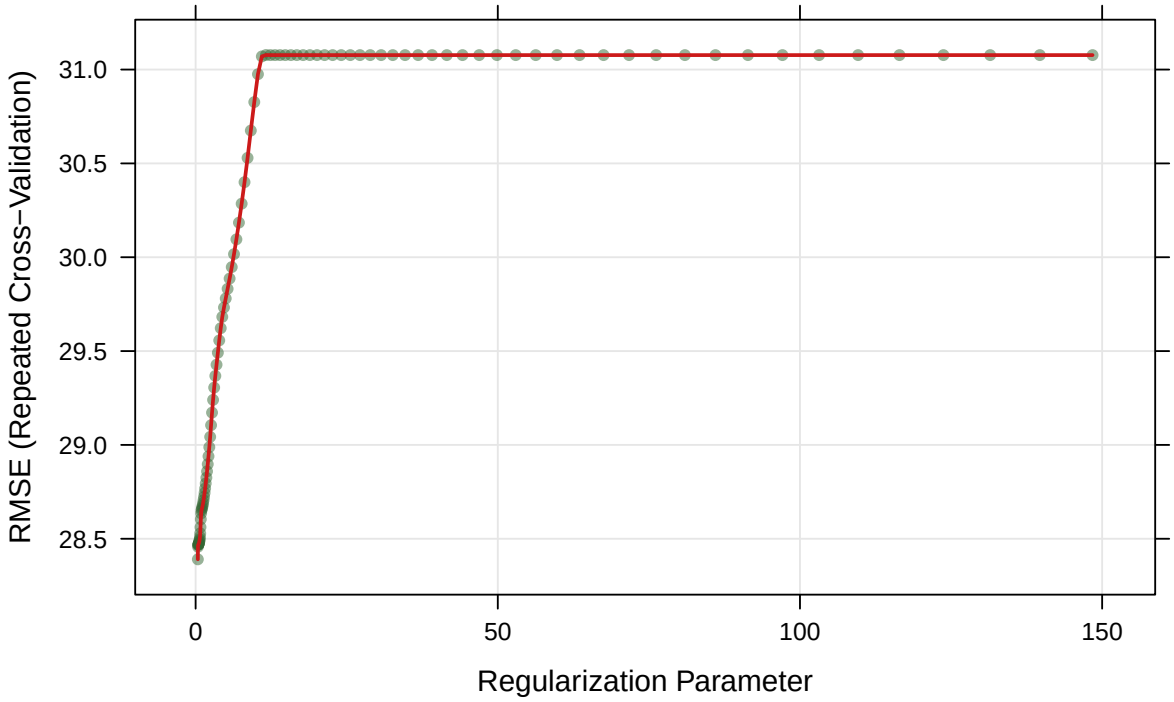
Figure 1. the relationship between predictors and recovery time



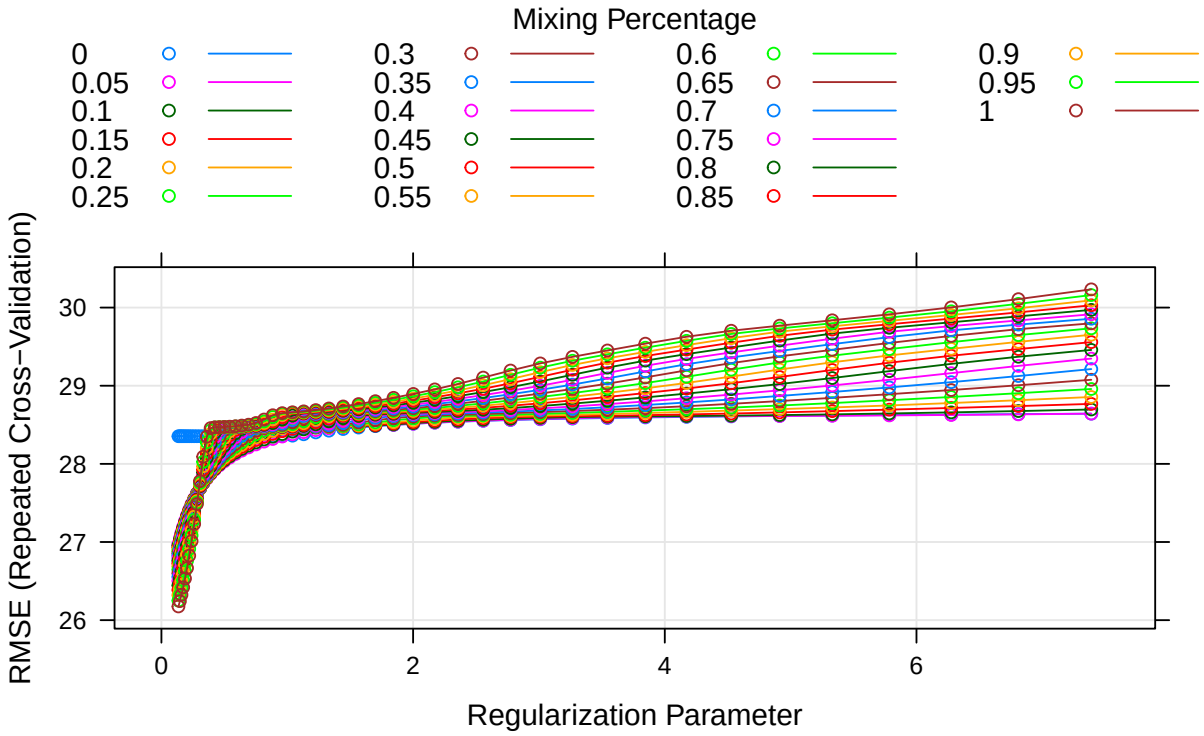



```
##
## Call:
## lm(formula = .outcome ~ ., data = dat)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -67.936 -13.844  -1.397  10.958 214.844
##
## Coefficients:
##                Estimate Std. Error t value Pr(>|t|)
## (Intercept)  -3.525e+03  1.866e+02 -18.894  < 2e-16 ***
## age          -8.418e-02  1.760e-01  -0.478  0.63260
## gender       -6.721e+00  1.386e+00  -4.849 1.38e-06 ***
## race2        -4.587e+00  3.202e+00  -1.433  0.15214
## race3        -2.286e+00  1.751e+00  -1.306  0.19189
## race4         3.600e-03  2.367e+00   0.002  0.99879
## smoking1      4.008e+00  1.543e+00   2.597  0.00949 **
## smoking2      7.161e+00  2.503e+00   2.861  0.00429 **
## height        2.060e+01  1.100e+00  18.723  < 2e-16 ***
## weight       -2.239e+01  1.162e+00 -19.275  < 2e-16 ***
## bmi           6.677e+01  3.303e+00  20.212  < 2e-16 ***
## hypertension  1.838e+00  2.307e+00   0.797  0.42565
## diabetes      1.562e+00  1.947e+00   0.803  0.42232
## SBP           1.048e-01  1.491e-01   0.703  0.48218
## LDL          -1.018e-02  3.601e-02  -0.283  0.77741
## vaccine      -8.737e+00  1.415e+00  -6.175 8.67e-10 ***
## severity      9.505e+00  2.314e+00   4.108 4.22e-05 ***
## studyB        4.580e+00  1.739e+00   2.634  0.00854 **
```

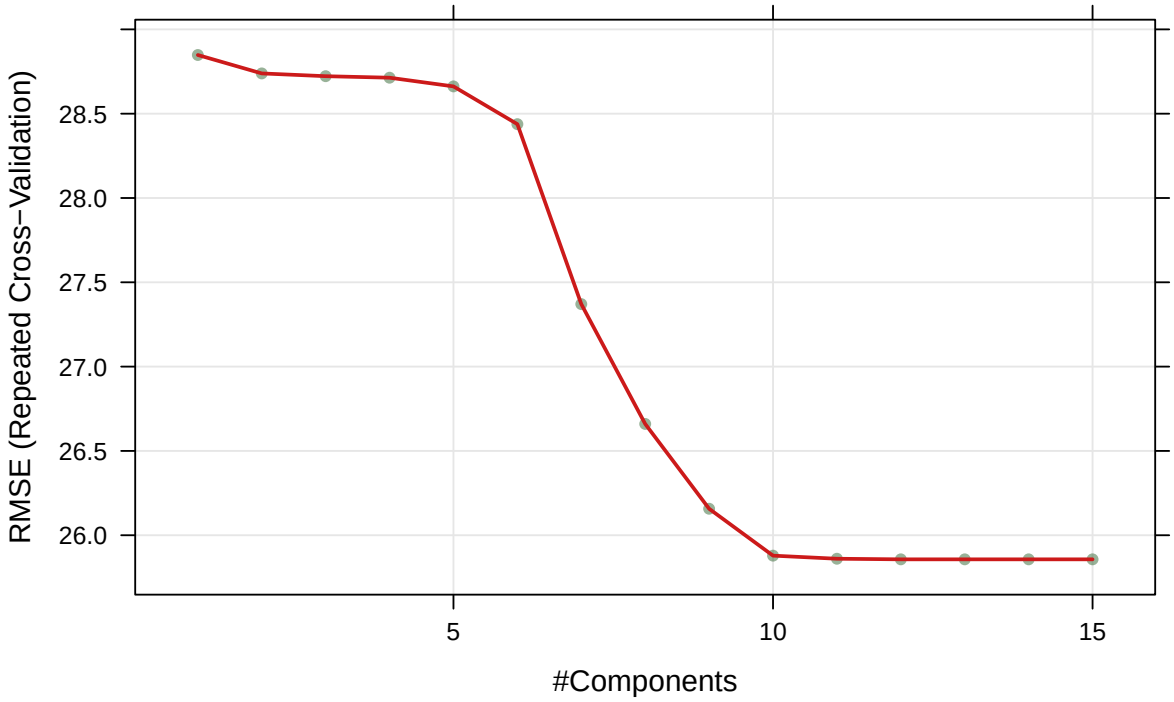
```
## studyC        3.436e-01  2.183e+00   0.157  0.87492
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 25.77 on 1383 degrees of freedom
## Multiple R-squared:  0.3552, Adjusted R-squared:  0.3468
## F-statistic: 42.32 on 18 and 1383 DF,  p-value: < 2.2e-16
## [1] 20.59645

## 19 x 1 sparse Matrix of class "dgCMatrix"
##                          s1
## (Intercept)  -93.205765308
## age             .
## gender        -5.919136420
## race2         -0.010213828
## race3         -1.777671736
## race4          .
## smoking1       1.948592247
## smoking2       6.302942295
## height         0.247367973
## weight        -0.890672253
## bmi            5.573001483
## hypertension   0.275670589
## diabetes       1.355426214
## SBP            0.105877149
## LDL           -0.001277377
## vaccine       -8.352237305
## severity      10.552981481
## studyB         5.646347276
## studyC         .
## [1] 24.77985
## [1] 0
```




```
##      alpha    lambda
## 1001     1 0.1353353
## [1] 20.05926
```



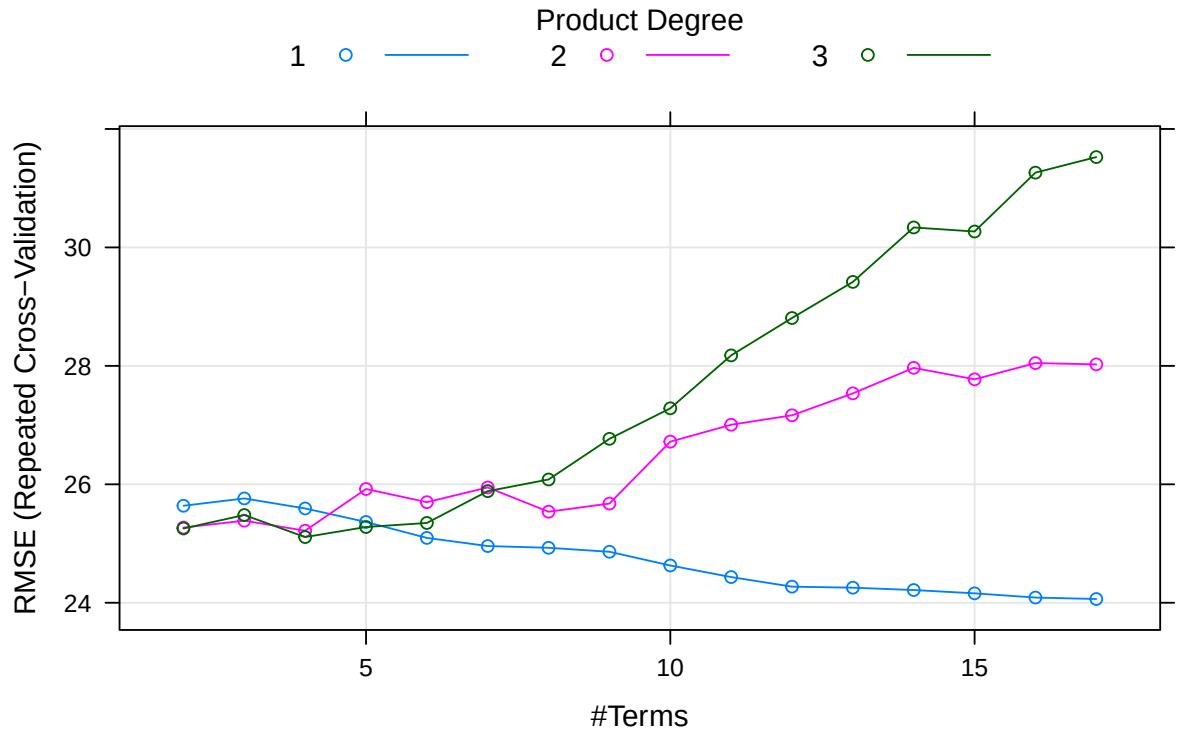

```
## Data:    X dimension: 1402 18
##  Y dimension: 1402 1
## Fit method: oscorespls
## Number of components considered: 12
## TRAINING: % variance explained
##           1 comps  2 comps  3 comps  4 comps  5 comps  6 comps  7 comps
## X           9.148    17.36    26.52    32.78    38.19    44.15    47.09
## .outcome   16.443    17.59    17.79    18.03    18.58    20.31    27.87
##           8 comps  9 comps  10 comps  11 comps  12 comps
## X           50.86    54.19     57.48     62.98     68.02
## .outcome    32.53    34.50     35.47     35.52     35.52
## [1] 20.59837
```



	nprune	degree
16	17	1

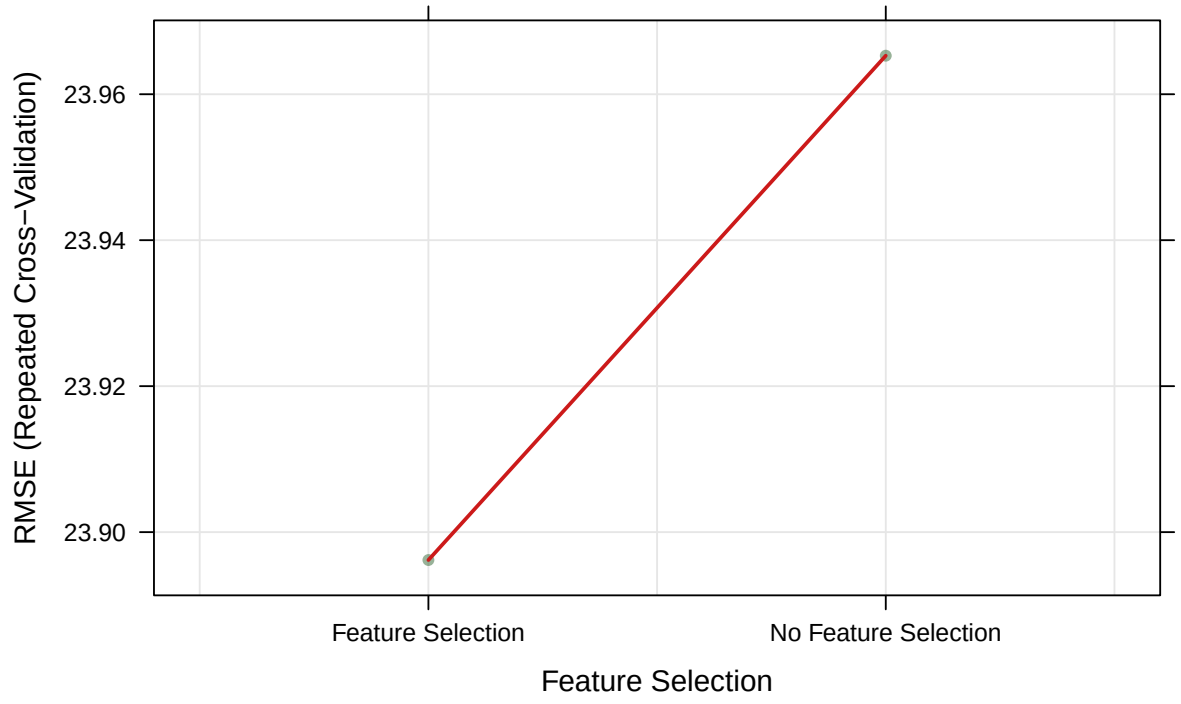
```
##     (Intercept)     h(bmi-31.7)     h(31.7-bmi)     h(bmi-35.1)         vaccine
##     -163.699095      -31.641543       34.176354       57.982767       -8.484611
## h(height-159.3) h(159.3-height)  h(90.6-weight)     h(bmi-29.4)          gender
##      -14.976026       15.911043       -4.815058       12.373579       -5.847346
##        severity     h(bmi-22.8)          studyB h(height-156.1)        smoking2
##        9.038245       26.313690        4.432291       12.770125        7.568910
##        smoking1  h(weight-67.3)
##        3.473229       -2.285645
## [1] 19.31587
## Call: earth(x=matrix[1402,18], y=c(23,25,37,10,4...), keepxy=TRUE, degree=1,
##             nprune=17)
##
##                 coefficients
## (Intercept)      -163.699095
## gender             -5.847346
## smoking1            3.473229
## smoking2            7.568910
## vaccine            -8.484611
## severity            9.038245
## studyB              4.432291
## h(height-156.1)    12.770125
## h(159.3-height)    15.911043
## h(height-159.3)   -14.976026
## h(weight-67.3)     -2.285645
```

```
## h(90.6-weight)     -4.815058
## h(bmi-22.8)        26.313690
## h(bmi-29.4)        12.373579
## h(31.7-bmi)        34.176354
## h(bmi-31.7)       -31.641543
## h(bmi-35.1)        57.982767
##
## Selected 17 of 22 terms, and 9 of 18 predictors (nprune=17)
## Termination condition: Reached nk 37
## Importance: bmi, vaccine, height, weight, gender, severity, studyB, ...
## Number of terms at each degree of interaction: 1 16 (additive model)
## GCV 521.9204    RSS 697691    GRSq 0.4868174    RSq 0.5099927
```



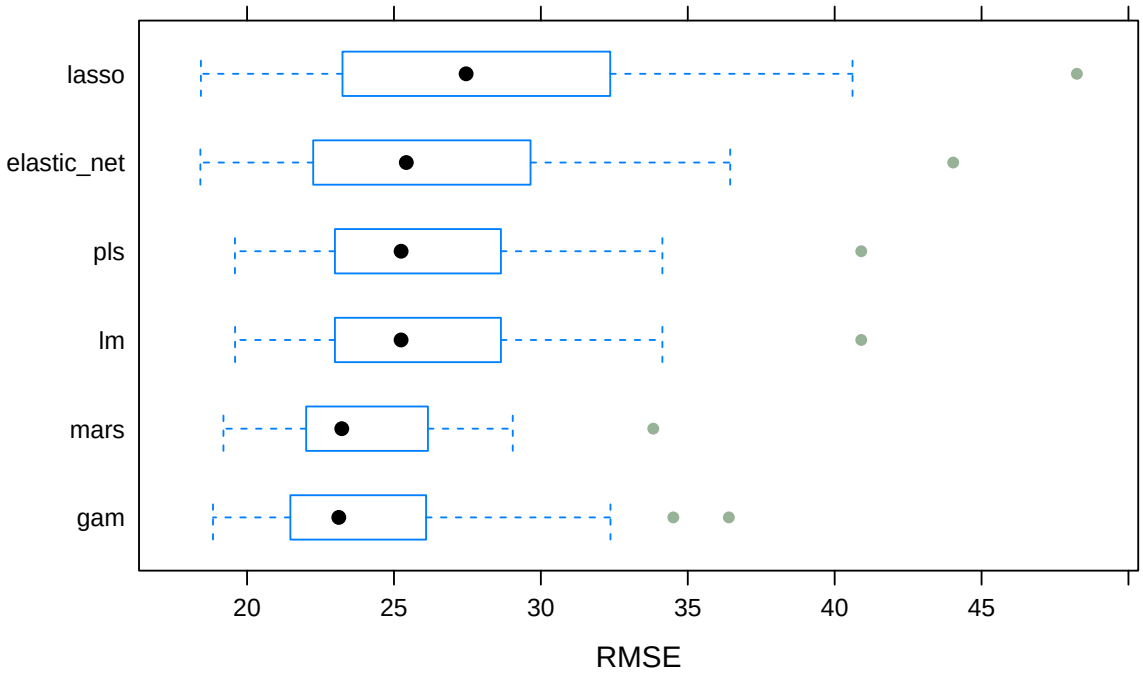

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## .outcome ~ gender + race2 + race3 + race4 + smoking1 + smoking2 +
##     hypertension + diabetes + vaccine + severity + studyB + studyC +
##     s(age) + s(SBP) + s(LDL) + s(bmi) + s(height) + s(weight)
##
## Parametric coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)   45.7757     1.8958  24.146  < 2e-16 ***
## gender        -5.8950     1.2196  -4.833 1.49e-06 ***
## race2         -4.7692     2.8264  -1.687  0.09176 .
```

```
## race3         -2.3028     1.5440  -1.491  0.13606
## race4         -2.2816     2.0921  -1.091  0.27565
## smoking1       3.5670     1.3643   2.614  0.00903 **
## smoking2       7.5238     2.2095   3.405  0.00068 ***
## hypertension   2.0701     1.2218   1.694  0.09044 .
## diabetes       2.1927     1.7190   1.276  0.20233
## vaccine       -8.1553     1.2483  -6.533 9.06e-11 ***
## severity       8.8627     2.0398   4.345 1.50e-05 ***
## studyB         4.3530     1.5327   2.840  0.00458 **
## studyC         0.1153     1.9233   0.060  0.95222
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Approximate significance of smooth terms:
##                 edf Ref.df      F  p-value
## s(age)    1.212e-09      9  0.000    0.971
## s(SBP)    2.143e-09      9  0.000    0.976
## s(LDL)    2.499e-09      9  0.000    0.873
## s(bmi)    8.753e+00      9 79.687  < 2e-16 ***
## s(height) 7.240e+00      9  6.053  < 2e-16 ***
## s(weight) 4.320e+00      9  5.018 5.48e-07 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## R-sq.(adj) =  0.497   Deviance explained = 50.9%
## GCV = 523.55  Scale est. = 511.11    n = 1402
## NULL
## [1] 19.36985
```



```
##
## Call:
## summary.resamples(object = res)
##
## Models: lm, lasso, elastic_net, pls, gam, mars
## Number of resamples: 50
##
## MAE
##                 Min.  1st Qu.   Median     Mean  3rd Qu.     Max. NA's
## lm          14.92169 16.79714 17.53143 17.48965 18.20362 20.65141    0
## lasso       14.44659 16.68324 17.68983 17.84015 18.87016 21.82297    0
## elastic_net 14.46166 16.27802 17.01237 17.06807 17.87792 20.75223    0
## pls         14.92145 16.79669 17.53011 17.48984 18.20224 20.65250    0
## gam         13.62327 15.14377 15.84965 16.05984 16.72174 19.57934    0
## mars        14.10529 15.40746 16.13835 16.17264 16.80479 19.07897    0
##
## RMSE
##                 Min.  1st Qu.   Median     Mean  3rd Qu.     Max. NA's
## lm          19.59117 23.05018 25.24154 25.85722 28.59408 40.90569    0
## lasso       18.42737 23.38819 27.45523 28.39035 32.31464 48.24480    0
## elastic_net 18.40971 22.26193 25.41912 26.17550 29.58809 44.03522    0
## pls         19.58634 23.05011 25.24227 25.85717 28.59370 40.90569    0
## gam         18.83947 21.49673 23.12193 23.89618 26.02227 36.39843    0
## mars        19.19470 22.04318 23.22292 24.06300 26.12428 33.82569    0
##
## Rsquared
##                   Min.   1st Qu.    Median      Mean   3rd Qu.      Max. NA's
## lm          0.119520680 0.2365440 0.3266709 0.3285216 0.4085749 0.5970516    0
## lasso       0.003666023 0.1352594 0.1871645 0.1856959 0.2323649 0.3296231    0
## elastic_net 0.102361853 0.2560678 0.3266106 0.3125386 0.3777359 0.5246915    0
## pls         0.119510263 0.2365178 0.3266308 0.3285227 0.4085783 0.5970333    0
## gam         0.108667896 0.2926807 0.3566997 0.4136214 0.5908192 0.7489117    0
## mars        0.156098173 0.2989208 0.3764912 0.4229348 0.5628118 0.7415360    0
```

Figure 2. Model Comparison




```
## [1] 23.96528 23.89618
## [1] 19.36985

##
## Family: gaussian
## Link function: identity
##
## Formula:
## recovery_time ~ gender + race + +smoking + hypertension + diabetes +
##     vaccine + severity + study + s(age) + s(SBP) + s(LDL) + s(bmi) +
##     s(height) + s(weight)
##
## Parametric coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)   45.8507     2.0477  22.391  < 2e-16 ***
## gender        -5.8254     1.2283  -4.743 2.33e-06 ***
## race2         -4.7591     2.8307  -1.681 0.092944 .
## race3         -2.3053     1.5474  -1.490 0.136504
## race4         -2.3204     2.0956  -1.107 0.268361
## smoking1       3.5753     1.3667   2.616 0.008992 **
## smoking2       7.5368     2.2135   3.405 0.000681 ***
## hypertension   1.7696     2.0366   0.869 0.385059
## diabetes       2.1977     1.7229   1.276 0.202329
## vaccine       -8.1433     1.2508  -6.510 1.05e-10 ***
## severity       8.9118     2.0454   4.357 1.42e-05 ***
## studyB         4.3804     1.5364   2.851 0.004421 **
## studyC         0.1369     1.9278   0.071 0.943408
```

```
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Approximate significance of smooth terms:
##             edf Ref.df      F  p-value
## s(age)    1.000  1.000  0.115    0.735
## s(SBP)    1.000  1.000  0.058    0.810
## s(LDL)    1.000  1.000  0.018    0.893
## s(bmi)    8.738  8.973 78.931  < 2e-16 ***
## s(height) 7.179  8.173  5.161 2.08e-06 ***
## s(weight) 5.084  6.224  5.775 5.00e-06 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## R-sq.(adj) =  0.496   Deviance explained = 50.9%
## GCV =  526.4  Scale est. = 512.51    n = 1402
```