Variable selection in individual patient data meta-analysis - stent dataset

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## glmm\_null

## Generalized linear mixed model fit by maximum likelihood (Laplace  
## Approximation) [glmerMod]  
## Family: binomial ( logit )  
## Formula: y ~ studyid + treat + (-1 + treat | studyid)  
## Data: mydata  
##   
## AIC BIC logLik deviance df.resid   
## 4285.6 4358.7 -2132.8 4265.6 11096   
##   
## Scaled residuals:   
## Min 1Q Median 3Q Max   
## -0.3634 -0.2931 -0.2288 -0.1224 10.4429   
##   
## Random effects:  
## Groups Name Variance Std.Dev.  
## studyid treat 0 0   
## Number of obs: 11106, groups: studyid, 8  
##   
## Fixed effects:  
## Estimate Std. Error z value Pr(>|z|)   
## (Intercept) -4.58259 0.32021 -14.311 < 2e-16 \*\*\*  
## studyid2 0.93318 0.35853 2.603 0.00925 \*\*   
## studyid3 1.18835 0.78536 1.513 0.13025   
## studyid4 1.74166 0.33903 5.137 2.79e-07 \*\*\*  
## studyid5 2.12812 0.34713 6.131 8.75e-10 \*\*\*  
## studyid6 0.49172 0.36076 1.363 0.17287   
## studyid7 2.19284 0.32634 6.720 1.82e-11 \*\*\*  
## studyid8 2.55808 0.32753 7.810 5.71e-15 \*\*\*  
## treat -0.10926 0.08704 -1.255 0.20938   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Correlation of Fixed Effects:  
## (Intr) stdyd2 stdyd3 stdyd4 stdyd5 stdyd6 stdyd7 stdyd8  
## studyid2 -0.878   
## studyid3 -0.401 0.358   
## studyid4 -0.923 0.830 0.379   
## studyid5 -0.907 0.810 0.370 0.857   
## studyid6 -0.868 0.780 0.356 0.827 0.805   
## studyid7 -0.965 0.862 0.393 0.912 0.890 0.857   
## studyid8 -0.961 0.859 0.392 0.908 0.887 0.854 0.943   
## treat -0.128 -0.001 -0.003 -0.043 0.000 -0.041 -0.002 -0.002  
## convergence code: 0  
## boundary (singular) fit: see ?isSingular

## glmm\_full

## Generalized linear mixed model fit by maximum likelihood (Laplace  
## Approximation) [glmerMod]  
## Family: binomial ( logit )  
## Formula:   
## y ~ studyid + (age + gender + diabetes + stable\_cad + multivessel +   
## ladtreated + overlap + m\_dia\_above\_3 + num\_stent) \* treat +   
## (-1 + treat | studyid)  
## Data: mydata  
##   
## AIC BIC logLik deviance df.resid   
## 4107.3 4312.1 -2025.7 4051.3 11078   
##   
## Scaled residuals:   
## Min 1Q Median 3Q Max   
## -1.0069 -0.2692 -0.1763 -0.1087 23.0529   
##   
## Random effects:  
## Groups Name Variance Std.Dev.  
## studyid treat 0 0   
## Number of obs: 11106, groups: studyid, 8  
##   
## Fixed effects:  
## Estimate Std. Error z value Pr(>|z|)   
## (Intercept) -4.299408 0.326634 -13.163 < 2e-16 \*\*\*  
## studyid2 0.524606 0.365260 1.436 0.150929   
## studyid3 1.071342 0.795265 1.347 0.177931   
## studyid4 1.059063 0.346319 3.058 0.002228 \*\*   
## studyid5 0.807254 0.360994 2.236 0.025339 \*   
## studyid6 0.298375 0.365182 0.817 0.413896   
## studyid7 1.355898 0.337655 4.016 5.93e-05 \*\*\*  
## studyid8 1.786975 0.334604 5.341 9.27e-08 \*\*\*  
## age 0.697817 0.088616 7.875 3.42e-15 \*\*\*  
## gender -0.009563 0.060064 -0.159 0.873499   
## diabetes 0.202784 0.056544 3.586 0.000335 \*\*\*  
## stable\_cad -0.264425 0.071444 -3.701 0.000215 \*\*\*  
## multivessel 0.148957 0.072012 2.068 0.038594 \*   
## ladtreated 0.098352 0.065133 1.510 0.131035   
## overlap 0.146446 0.064927 2.256 0.024099 \*   
## m\_dia\_above\_3 -0.051418 0.047019 -1.094 0.274153   
## num\_stent 0.017515 0.070713 0.248 0.804373   
## treat 0.044368 0.118005 0.376 0.706930   
## age:treat -0.084909 0.114654 -0.741 0.458958   
## gender:treat 0.021694 0.084674 0.256 0.797793   
## diabetes:treat -0.033872 0.078758 -0.430 0.667143   
## stable\_cad:treat 0.054410 0.096455 0.564 0.572688   
## multivessel:treat -0.087968 0.093551 -0.940 0.347053   
## ladtreated:treat -0.184145 0.089987 -2.046 0.040723 \*   
## overlap:treat -0.015321 0.091473 -0.167 0.866983   
## m\_dia\_above\_3:treat 0.094494 0.073102 1.293 0.196138   
## num\_stent:treat -0.081490 0.102641 -0.794 0.427233   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
## convergence code: 0  
## boundary (singular) fit: see ?isSingular

## naive step

##   
## Call:  
## glm(formula = y ~ age + diabetes + stable\_cad + multivessel +   
## ladtreated + overlap + num\_stent + treat + ladtreated:treat +   
## num\_stent:treat, family = binomial(link = "logit"), data = mydata)  
##   
## Deviance Residuals:   
## Min 1Q Median 3Q Max   
## -1.0062 -0.3717 -0.2657 -0.1836 3.4074   
##   
## Coefficients:  
## Estimate Std. Error z value Pr(>|z|)   
## (Intercept) -3.20028 0.07519 -42.560 < 2e-16 \*\*\*  
## age 0.80570 0.05549 14.520 < 2e-16 \*\*\*  
## diabetes 0.21441 0.03895 5.505 3.69e-08 \*\*\*  
## stable\_cad -0.22341 0.04774 -4.680 2.87e-06 \*\*\*  
## multivessel 0.07726 0.04624 1.671 0.094751 .   
## ladtreated 0.12197 0.06399 1.906 0.056637 .   
## overlap 0.17471 0.04530 3.856 0.000115 \*\*\*  
## num\_stent 0.05720 0.06021 0.950 0.342126   
## treat -0.09185 0.08937 -1.028 0.304083   
## ladtreated:treat -0.16787 0.08865 -1.894 0.058279 .   
## num\_stent:treat -0.11751 0.07821 -1.503 0.132948   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## (Dispersion parameter for binomial family taken to be 1)  
##   
## Null deviance: 4565.3 on 11105 degrees of freedom  
## Residual deviance: 4176.2 on 11095 degrees of freedom  
## AIC: 4198.2  
##   
## Number of Fisher Scoring iterations: 6

## naive lasso

## 20 x 1 sparse Matrix of class "dgCMatrix"  
## 1  
## (Intercept) -2.7827729  
## age .   
## gender .   
## diabetes .   
## stable\_cad .   
## multivessel .   
## ladtreated .   
## overlap .   
## m\_dia\_above\_3 .   
## num\_stent .   
## treat -0.2104127  
## age:treat .   
## gender:treat .   
## diabetes:treat .   
## stable\_cad:treat .   
## multivessel:treat .   
## ladtreated:treat .   
## overlap:treat .   
## m\_dia\_above\_3:treat .   
## num\_stent:treat .

## glmmLasso

## [1] "Iteration 1"  
## [1] "Iteration 2"  
## [1] "Iteration 3"  
## [1] "Iteration 4"  
## [1] "Iteration 5"  
## [1] "Iteration 6"  
## [1] "Iteration 7"  
## [1] "Iteration 8"  
## [1] "Iteration 9"  
## [1] "Iteration 10"  
## Warning:  
## Algorithm did not converge!  
## [1] "Iteration 11"

## Call:  
## glmmLasso(fix = form.fixed, rnd = form.rnd, data = data\_glmmLasso,   
## lambda = lambda.min, family = family, control = list(index = c(NA,   
## 1:((dim(data\_glmmLasso)[2] - 3)), NA), center = FALSE,   
## standardize = FALSE))  
##   
##   
## Fixed Effects:  
##   
## Coefficients:  
## Estimate StdErr z.value p.value  
## (Intercept) -2.6029877 NA NA NA  
## age 0.5210038 NA NA NA  
## gender -0.0106568 NA NA NA  
## diabetes 0.1308153 NA NA NA  
## stable\_cad -0.1752737 NA NA NA  
## multivessel 0.0206220 NA NA NA  
## ladtreated 0.0016533 NA NA NA  
## overlap 0.0884200 NA NA NA  
## m\_dia\_above\_3 -0.0142569 NA NA NA  
## num\_stent 0.0149336 NA NA NA  
## age\_treat 0.0732611 NA NA NA  
## gender\_treat 0.0023773 NA NA NA  
## diabetes\_treat 0.0116424 NA NA NA  
## stable\_cad\_treat -0.0123928 NA NA NA  
## multivessel\_treat 0.0000000 NA NA NA  
## ladtreated\_treat -0.0118007 NA NA NA  
## overlap\_treat 0.0087406 NA NA NA  
## m\_dia\_above\_3\_treat 0.0000000 NA NA NA  
## num\_stent\_treat 0.0000000 NA NA NA  
## as.factor(studyid)2 -0.5994774 NA NA NA  
## as.factor(studyid)3 -0.0322437 NA NA NA  
## as.factor(studyid)4 -0.2581744 NA NA NA  
## as.factor(studyid)5 -0.3330632 NA NA NA  
## as.factor(studyid)6 -0.7064192 NA NA NA  
## as.factor(studyid)7 -0.1659291 NA NA NA  
## as.factor(studyid)8 0.2116245 NA NA NA  
## treat -0.4340439 NA NA NA  
##   
## Random Effects:  
##   
## StdDev:  
## treat:studyid  
## treat:studyid 0.2577269

## [1] 40

## Bayes Lasso

## SSVS

##   
## Parallel computation in progress

##   
## Iterations = 301:2300  
## Thinning interval = 1   
## Number of chains = 2   
## Sample size per chain = 2000   
##   
## 1. Empirical mean and standard deviation for each variable,  
## plus standard error of the mean:  
##   
## Mean SD Naive SE Time-series SE  
## Ind[1] 1.000000 0.00000 0.0000000 0.0000000  
## Ind[2] 0.157000 0.36385 0.0057529 0.0071649  
## Ind[3] 0.929750 0.25560 0.0040414 0.0115043  
## Ind[4] 0.976500 0.15150 0.0023955 0.0061459  
## Ind[5] 0.539750 0.49848 0.0078817 0.0230155  
## Ind[6] 0.278500 0.44832 0.0070885 0.0213594  
## Ind[7] 0.762000 0.42591 0.0067343 0.0192704  
## Ind[8] 0.167000 0.37302 0.0058980 0.0079044  
## Ind[9] 0.210500 0.40771 0.0064465 0.0138315  
## Ind2[1] 0.334250 0.47179 0.0074596 0.0171829  
## Ind2[2] 0.199750 0.39986 0.0063224 0.0087948  
## Ind2[3] 0.234000 0.42343 0.0066949 0.0105489  
## Ind2[4] 0.279750 0.44893 0.0070982 0.0129372  
## Ind2[5] 0.303250 0.45972 0.0072688 0.0176222  
## Ind2[6] 0.533500 0.49894 0.0078889 0.0243079  
## Ind2[7] 0.237250 0.42545 0.0067270 0.0151084  
## Ind2[8] 0.259500 0.43842 0.0069320 0.0121843  
## Ind2[9] 0.319500 0.46634 0.0073735 0.0155870  
## alpha[1] -4.365780 0.35628 0.0056332 0.0112283  
## alpha[2] -3.698330 0.19398 0.0030671 0.0052271  
## alpha[3] -3.441361 0.83399 0.0131865 0.0184098  
## alpha[4] -3.143129 0.16404 0.0025936 0.0067496  
## alpha[5] -3.481948 0.21804 0.0034476 0.0111675  
## alpha[6] -3.889303 0.22837 0.0036108 0.0087460  
## alpha[7] -2.882106 0.12632 0.0019973 0.0064068  
## alpha[8] -2.468856 0.12618 0.0019950 0.0062294  
## beta[1] 0.649204 0.07990 0.0012633 0.0043767  
## beta[2] -0.002767 0.03316 0.0005244 0.0008304  
## beta[3] 0.183247 0.05101 0.0008066 0.0016827  
## beta[4] -0.241271 0.05849 0.0009248 0.0019178  
## beta[5] 0.089797 0.06996 0.0011062 0.0038528  
## beta[6] 0.036475 0.05531 0.0008746 0.0031521  
## beta[7] 0.129260 0.05958 0.0009421 0.0027272  
## beta[8] -0.013896 0.03285 0.0005194 0.0010611  
## beta[9] 0.014795 0.04445 0.0007028 0.0020344  
## d[1] 0.000000 0.00000 0.0000000 0.0000000  
## d[2] -0.042269 0.15910 0.0025156 0.0083256  
## eta 0.036325 0.01652 0.0002612 0.0012127  
## g[1] -0.036531 0.08103 0.0012812 0.0050525  
## g[2] 0.009593 0.04265 0.0006743 0.0011119  
## g[3] -0.009468 0.05138 0.0008125 0.0016918  
## g[4] 0.015701 0.05947 0.0009403 0.0021463  
## g[5] -0.034182 0.07206 0.0011393 0.0041006  
## g[6] -0.096166 0.08933 0.0014125 0.0057420  
## g[7] -0.015848 0.05713 0.0009033 0.0024529  
## g[8] 0.033854 0.05201 0.0008223 0.0018222  
## g[9] -0.041841 0.06528 0.0010321 0.0027115  
## sdDelta 0.236119 0.20751 0.0032811 0.0190073  
##   
## 2. Quantiles for each variable:  
##   
## 2.5% 25% 50% 75% 97.5%  
## Ind[1] 1.00000 1.0000000 1.000000 1.0000000 1.00000  
## Ind[2] 0.00000 0.0000000 0.000000 0.0000000 1.00000  
## Ind[3] 0.00000 1.0000000 1.000000 1.0000000 1.00000  
## Ind[4] 1.00000 1.0000000 1.000000 1.0000000 1.00000  
## Ind[5] 0.00000 0.0000000 1.000000 1.0000000 1.00000  
## Ind[6] 0.00000 0.0000000 0.000000 1.0000000 1.00000  
## Ind[7] 0.00000 1.0000000 1.000000 1.0000000 1.00000  
## Ind[8] 0.00000 0.0000000 0.000000 0.0000000 1.00000  
## Ind[9] 0.00000 0.0000000 0.000000 0.0000000 1.00000  
## Ind2[1] 0.00000 0.0000000 0.000000 1.0000000 1.00000  
## Ind2[2] 0.00000 0.0000000 0.000000 0.0000000 1.00000  
## Ind2[3] 0.00000 0.0000000 0.000000 0.0000000 1.00000  
## Ind2[4] 0.00000 0.0000000 0.000000 1.0000000 1.00000  
## Ind2[5] 0.00000 0.0000000 0.000000 1.0000000 1.00000  
## Ind2[6] 0.00000 0.0000000 1.000000 1.0000000 1.00000  
## Ind2[7] 0.00000 0.0000000 0.000000 0.0000000 1.00000  
## Ind2[8] 0.00000 0.0000000 0.000000 1.0000000 1.00000  
## Ind2[9] 0.00000 0.0000000 0.000000 1.0000000 1.00000  
## alpha[1] -5.10651 -4.5862499 -4.343942 -4.1153741 -3.75409  
## alpha[2] -4.09716 -3.8283973 -3.690281 -3.5681348 -3.33698  
## alpha[3] -5.31980 -3.9519760 -3.346228 -2.8378418 -2.04940  
## alpha[4] -3.46563 -3.2543934 -3.143514 -3.0312953 -2.82305  
## alpha[5] -3.94490 -3.6239000 -3.468954 -3.3308140 -3.08751  
## alpha[6] -4.34001 -4.0415554 -3.893263 -3.7374125 -3.43609  
## alpha[7] -3.13843 -2.9680248 -2.878048 -2.7994253 -2.63355  
## alpha[8] -2.73730 -2.5464056 -2.465580 -2.3814787 -2.23245  
## beta[1] 0.50158 0.5957942 0.646293 0.6985053 0.81774  
## beta[2] -0.07448 -0.0212631 -0.002030 0.0170184 0.06103  
## beta[3] 0.07230 0.1527305 0.184088 0.2175355 0.27858  
## beta[4] -0.35755 -0.2797137 -0.241166 -0.2019175 -0.12971  
## beta[5] -0.01483 0.0352464 0.078829 0.1346225 0.24805  
## beta[6] -0.04163 0.0004723 0.022744 0.0600652 0.18176  
## beta[7] 0.01836 0.0874300 0.129268 0.1692020 0.24786  
## beta[8] -0.08666 -0.0328740 -0.011006 0.0068047 0.04520  
## beta[9] -0.06674 -0.0109525 0.010545 0.0353235 0.12339  
## d[1] 0.00000 0.0000000 0.000000 0.0000000 0.00000  
## d[2] -0.36296 -0.1319946 -0.041323 0.0511149 0.26921  
## eta 0.01754 0.0253461 0.031855 0.0420765 0.08212  
## g[1] -0.25136 -0.0617056 -0.017291 0.0110260 0.08378  
## g[2] -0.06828 -0.0155473 0.006064 0.0309117 0.10707  
## g[3] -0.13147 -0.0338051 -0.006331 0.0180546 0.09414  
## g[4] -0.09385 -0.0174956 0.009436 0.0411632 0.16314  
## g[5] -0.23393 -0.0570359 -0.016483 0.0084493 0.06738  
## g[6] -0.29647 -0.1558776 -0.077506 -0.0235702 0.02755  
## g[7] -0.16211 -0.0366663 -0.008680 0.0141376 0.08265  
## g[8] -0.04078 0.0003234 0.022620 0.0556779 0.16793  
## g[9] -0.20846 -0.0698064 -0.026103 -0.0007135 0.05147  
## sdDelta 0.01155 0.0890676 0.178315 0.3236295 0.79284

## Potential scale reduction factors:  
##   
## Point est. Upper C.I.  
## Ind[1] NaN NaN  
## Ind[2] 1.00 1.00  
## Ind[3] 1.01 1.02  
## Ind[4] 1.01 1.01  
## Ind[5] 1.00 1.00  
## Ind[6] 1.00 1.01  
## Ind[7] 1.01 1.04  
## Ind[8] 1.01 1.02  
## Ind[9] 1.01 1.03  
## Ind2[1] 1.04 1.16  
## Ind2[2] 1.00 1.01  
## Ind2[3] 1.00 1.01  
## Ind2[4] 1.00 1.00  
## Ind2[5] 1.00 1.00  
## Ind2[6] 1.02 1.08  
## Ind2[7] 1.02 1.06  
## Ind2[8] 1.00 1.02  
## Ind2[9] 1.00 1.01  
## alpha[1] 1.02 1.11  
## alpha[2] 1.00 1.00  
## alpha[3] 1.00 1.00  
## alpha[4] 1.01 1.01  
## alpha[5] 1.05 1.20  
## alpha[6] 1.00 1.00  
## alpha[7] 1.05 1.19  
## alpha[8] 1.05 1.18  
## beta[1] 1.03 1.11  
## beta[2] 1.00 1.01  
## beta[3] 1.00 1.00  
## beta[4] 1.00 1.01  
## beta[5] 1.00 1.00  
## beta[6] 1.02 1.08  
## beta[7] 1.03 1.12  
## beta[8] 1.01 1.04  
## beta[9] 1.00 1.03  
## d[1] NaN NaN  
## d[2] 1.05 1.22  
## eta 1.03 1.05  
## g[1] 1.09 1.30  
## g[2] 1.00 1.01  
## g[3] 1.01 1.02  
## g[4] 1.01 1.03  
## g[5] 1.00 1.00  
## g[6] 1.04 1.15  
## g[7] 1.08 1.26  
## g[8] 1.01 1.02  
## g[9] 1.01 1.03  
## sdDelta 1.09 1.34