

week_8

Lindsey Greenhill

4/14/2022

Question 1

I split the data into a training and test group. There are 4865 observations in the training group and 43919 in the test group.

Question 2

```
##
## Call:
## randomForest(formula = reformulate(exclude_race, "cost_t"), data = training,          ntree = 100, mtry
##               Type of random forest: regression
##               Number of trees: 100
## No. of variables tried at each split: 149
##
##               Mean of squared residuals: 269244009
##               % Var explained: 5.62

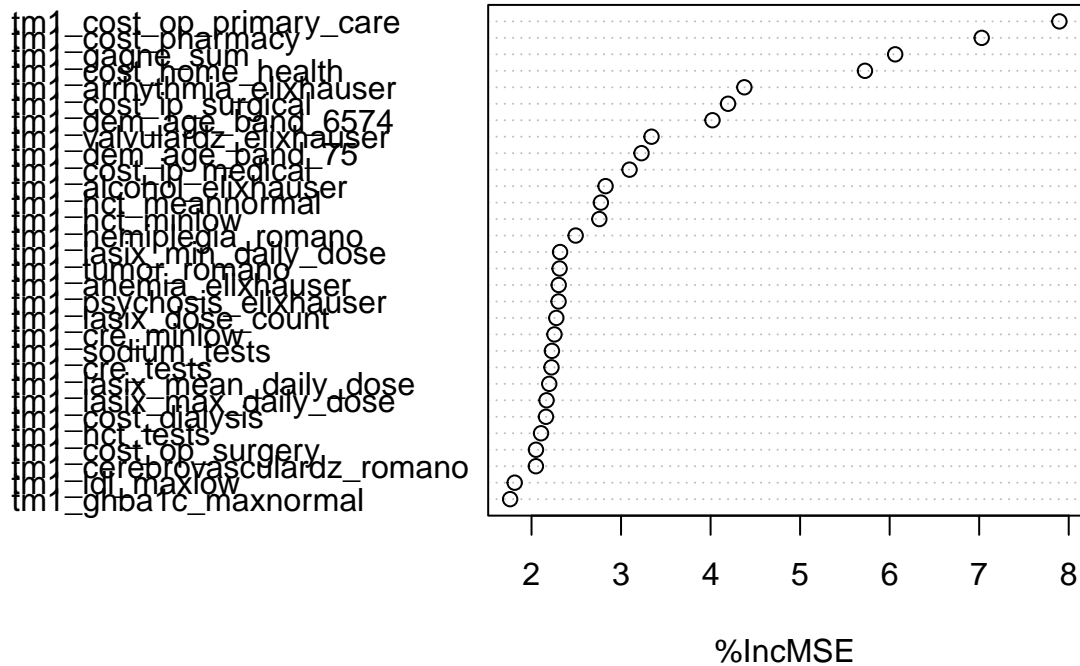
##               %IncMSE  IncNodePurity
## tm1_dem_female      0.972831388 15237025525.3
## tm1_dem_age_band_1824 -0.425306068 2733191271.2
## tm1_dem_age_band_2534 0.163948915 2573121856.4
## tm1_dem_age_band_3544 1.304778165 2966690483.5
## tm1_dem_age_band_4554 0.612065460 7149820449.9
## tm1_dem_age_band_5564 -1.240524649 3571558803.8
## tm1_dem_age_band_6574 4.021325501 3668936721.9
## tm1_dem_age_band_75   3.228859603 5711672455.1
## tm1_alcohol_elixhauser 2.827357003 2619666795.5
## tm1_anemia_elixhauser 2.304002108 4308203601.4
## tm1_arrhythmia_elixhauser 4.377240942 3875298305.6
## tm1_arthritis_elixhauser 1.120573272 1167054275.0
## tm1_bloodlossanemia_elixhauser 0.378909377 3144722877.3
## tm1_coagulopathy_elixhauser -0.390631751 1171160241.3
## tm1_compdiabetes_elixhauser 0.571236616 5856997934.7
## tm1_depression_elixhauser -2.915128403 1634465720.0
## tm1_drugabuse_elixhauser 1.252764408 2277919967.8
## tm1_electrolytes_elixhauser 0.173050143 971712963.7
## tm1_hypertension_elixhauser 1.288079871 6108491658.0
## tm1_hypothyroid_elixhauser 1.745671527 3554163478.2
## tm1_liver_elixhauser 1.252932690 507765195.2
## tm1_neurodegen_elixhauser -0.995986652 1957000700.6
```

## tm1_obesity_elixhauser	1.706790200	1946766018.9
## tm1_paralysis_elixhauser	0.000000000	12548268.9
## tm1_psychosis_elixhauser	2.302382686	3009753324.2
## tm1_pulmcirc_elixhauser	-1.067070728	297554381.8
## tm1_pvd_elixhauser	0.764044716	2399713917.0
## tm1_renal_elixhauser	-1.209939244	4846049355.1
## tm1_uncompdiabetes_elixhauser	-0.386786214	1881829548.6
## tm1_valvulardz_elixhauser	3.340454870	3787817530.7
## tm1_wtloss_elixhauser	1.005037815	25122829.2
## tm1_cerebrovasculardz_romano	2.048944941	901135189.5
## tm1_chf_romano	-0.635346738	1007047175.7
## tm1_dementia_romano	-0.621244173	365059039.9
## tm1_hemiplegia_romano	2.493143028	1327886880.5
## tm1_hivaidz_romano	0.552875705	4204405325.7
## tm1_metastatic_romano	-0.568987667	3804687405.4
## tm1_myocardialinfarct_romano	-2.399419258	1749336234.5
## tm1_pulmonarydz_romano	1.380124698	3090719847.4
## tm1_tumor_romano	2.313646763	3004860253.6
## tm1_ulcer_romano	-2.421395755	11003450377.7
## tm1_cost_dialysis	2.161586663	12776381686.8
## tm1_cost_emergency	-1.286124937	86078534050.2
## tm1_cost_home_health	5.724344043	15998650026.1
## tm1_cost_ip_medical	3.094967516	44061779076.2
## tm1_cost_ip_surgical	4.195321065	6047212215.0
## tm1_cost_laboratory	-2.349430138	105674591820.9
## tm1_cost_op_primary_care	7.895865312	42781027118.0
## tm1_cost_op_specialists	-0.180201607	63042974893.5
## tm1_cost_op_surgery	2.049722492	33288772294.6
## tm1_cost_other	-3.032641154	91165638811.6
## tm1_cost_pharmacy	7.028358641	58368378740.8
## tm1_cost_physical_therapy	-1.303196436	28128461602.3
## tm1_cost_radiology	0.939167135	27322347995.5
## tm1_lasix_dose_count	2.277111406	20866904215.6
## tm1_lasix_min_daily_dose	2.319060073	21385911740.4
## tm1_lasix_mean_daily_dose	2.198127013	13752490388.2
## tm1_lasix_max_daily_dose	2.168106577	20685653573.6
## tm1_cre_tests	2.223259492	25562120873.9
## tm1_crp_tests	0.000000000	203264282.4
## tm1_esr_tests	0.434911774	6234323680.9
## tm1_ghbaltc_tests	-1.170237855	4394110020.7
## tm1_hct_tests	2.106416785	38202885707.7
## tm1_ldl_tests	1.491203531	3623932781.3
## tm1_nt_bnp_tests	-0.307149867	3214440235.1
## tm1_sodium_tests	2.228007544	5284363467.4
## tm1_trig_tests	0.694791145	5475816965.5
## tm1_cre_minlow	2.256154662	1240549667.5
## tm1_cre_minhigh	-0.440211847	2792842670.0
## tm1_cre_minnormal	0.803034658	1799846225.1
## tm1_cre_meanlow	-0.147615821	1296842455.1
## tm1_cre_meanhigh	-1.482521231	1570524142.8
## tm1_cre_meannormal	0.205803468	1025893796.3
## tm1_cre_maxlow	1.121909778	6675012769.5
## tm1_cre_maxhigh	0.062348520	1373510381.6
## tm1_cre_maxnormal	1.226394204	8513653347.0

## tm1_crp_minlow	0.000000000	78455822.5
## tm1_crp_minhigh	0.000000000	50921537.9
## tm1_crp_minnormal	0.000000000	0.0
## tm1_crp_meanlow	0.000000000	0.0
## tm1_crp_meanhigh	0.000000000	39308341.7
## tm1_crp_meannormal	0.000000000	0.0
## tm1_crp_maxlow	0.000000000	140257179.0
## tm1_crp_maxhigh	1.005037815	28568132.9
## tm1_crp_maxnormal	0.000000000	0.0
## tm1_esr_minlow	0.000000000	0.0
## tm1_esr_minhigh	1.155420153	853923400.3
## tm1_esr_minnormal	0.911942386	1874420481.3
## tm1_esr_meanlow	0.000000000	0.0
## tm1_esr_meanhigh	-1.037562605	257813374.0
## tm1_esr_meannormal	-1.015622912	2037493242.6
## tm1_esr_maxlow	0.000000000	0.0
## tm1_esr_maxhigh	-0.847894514	825377599.5
## tm1_esr_maxnormal	-0.267124700	1932010036.7
## tm1_ghba1c_minlow	0.000000000	0.0
## tm1_ghba1c_minhigh	0.799361818	923376529.9
## tm1_ghba1c_minnormal	-1.420051717	1337505117.8
## tm1_ghba1c_meanlow	0.000000000	233369.0
## tm1_ghba1c_meanhigh	-0.018218793	640921809.1
## tm1_ghba1c_meannormal	1.078325035	1275795044.7
## tm1_ghba1c_maxlow	0.000000000	0.0
## tm1_ghba1c_maxhigh	-0.817080784	521184630.7
## tm1_ghba1c_maxnormal	1.761404269	2291228433.7
## tm1_hct_minlow	2.757619179	2628612403.0
## tm1_hct_minhigh	-1.505915208	346513161.4
## tm1_hct_minnormal	0.857603762	1180763340.2
## tm1_hct_meanlow	-0.669626708	1880078569.7
## tm1_hct_meanhigh	-1.467585356	231914361.6
## tm1_hct_meannormal	2.774924099	2017567068.0
## tm1_hct_maxlow	0.107241299	4145393530.5
## tm1_hct_maxhigh	-0.008948292	209445108.7
## tm1_hct_maxnormal	0.999279410	2485863187.4
## tm1_ldl_minlow	0.808705990	565429747.8
## tm1_ldl_minhigh	1.349792840	8615792349.1
## tm1_ldl_minnormal	0.531660718	13102601819.4
## tm1_ldl_meanlow	-0.792090976	968574508.1
## tm1_ldl_meanhigh	-1.364895812	8642509831.6
## tm1_ldl_meannormal	-0.652212932	1789785623.2
## tm1_ldl_maxlow	1.812156263	1116217675.6
## tm1_ldl_maxhigh	1.463162148	5708767504.7
## tm1_ldl_maxnormal	1.423137059	1464342778.3
## tm1_nt_bnp_minlow	0.826950025	263722611.5
## tm1_nt_bnp_minhigh	1.433311226	8287026668.5
## tm1_nt_bnp_minnormal	0.429829268	1173569589.7
## tm1_nt_bnp_meanlow	0.025992048	72193955.5
## tm1_nt_bnp_meanhigh	0.580965374	4038618372.4
## tm1_nt_bnp_meannormal	1.005037815	3592416.8
## tm1_nt_bnp_maxlow	-1.127643772	142884289.0
## tm1_nt_bnp_maxhigh	0.357835801	852946872.2
## tm1_nt_bnp_maxnormal	0.000000000	33482696.3

## tml_sodium_minlow	-0.735934771	1233296343.4
## tml_sodium_minhigh	0.000000000	1132353.5
## tml_sodium_minnormal	0.611199506	1650598128.8
## tml_sodium_meanlow	0.612165827	2957645972.3
## tml_sodium_meanhigh	0.000000000	574586.5
## tml_sodium_meannormal	0.550339001	955486463.4
## tml_sodium_maxlow	-1.504556663	702049148.7
## tml_sodium_maxhigh	-0.864054849	1810535460.4
## tml_sodium_maxnormal	1.502529823	1825436566.3
## tml_trig_minlow	-0.971094368	1523253694.1
## tml_trig_minhigh	1.008423214	695335577.3
## tml_trig_minnormal	1.237961319	1078033296.9
## tml_trig_meanlow	-1.271982939	2358163369.6
## tml_trig_meanhigh	1.398320032	904950133.1
## tml_trig_meannormal	0.126113195	1290030426.0
## tml_trig_maxlow	0.530146825	4309564082.8
## tml_trig_maxhigh	-0.173343242	708945461.2
## tml_trig_maxnormal	0.991964832	15041843313.5
## tml_gagne_sum	6.061939543	155763340685.8

mod1



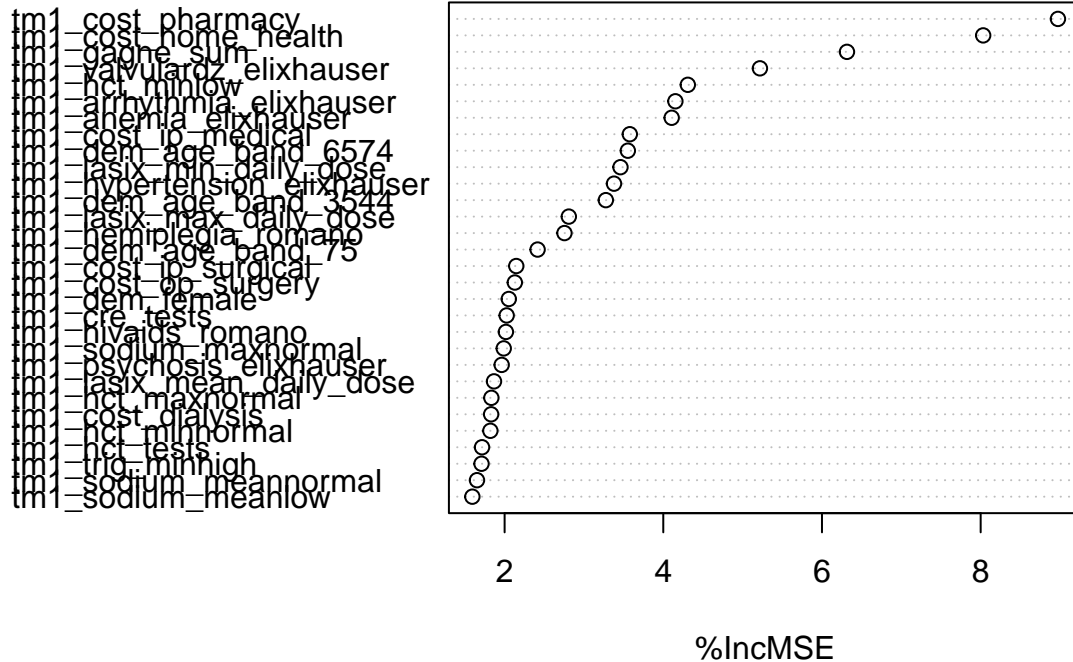
```
##
## Call:
##   randomForest(formula = reformulate(all_predictors, "cost_t"), data = training, ntree = 100, mt
##           Type of random forest: regression
##           Number of trees: 100
## No. of variables tried at each split: 150
##
##           Mean of squared residuals: 271454722
##           % Var explained: 4.84
```

	%IncMSE	IncNodePurity
tm1_dem_black	0.40384102	2171028513.4
tm1_dem_female	2.05289965	4863299371.8
tm1_dem_age_band_1824	-0.12974598	3001114473.0
tm1_dem_age_band_2534	-1.49879463	2358185865.4
tm1_dem_age_band_3544	3.27605409	2114019587.0
tm1_dem_age_band_4554	-0.92996208	7195289618.1
tm1_dem_age_band_5564	0.09043911	3310475733.5
tm1_dem_age_band_6574	3.55321427	4036198316.7
tm1_dem_age_band_75	2.41604375	6101667489.2
tm1_alcohol_elixhauser	1.40084079	2491271948.6
tm1_anemia_elixhauser	4.10568865	3272637575.4
tm1_arrhythmia_elixhauser	4.15254916	3382430600.7
tm1_arthritis_elixhauser	-0.29671621	1552402089.0
tm1_bloodlossanemia_elixhauser	-1.49733883	5241535444.4
tm1_coagulopathy_elixhauser	-0.11130007	1275445326.7
tm1_compdiabetes_elixhauser	1.27860054	5323549960.1
tm1_depression_elixhauser	0.18197723	1071070775.2
tm1_drugabuse_elixhauser	0.03941191	2457057731.4
tm1_electrolytes_elixhauser	-0.72684773	788408704.6
tm1_hypertension_elixhauser	3.37894327	3933967137.6
tm1_hypothyroid_elixhauser	-0.26543458	4147781442.6
tm1_liver_elixhauser	0.64206539	363089889.7
tm1_neurodegen_elixhauser	-2.42680961	2130211896.7
tm1_obesity_elixhauser	-1.09191343	1336694271.6
tm1_paralysis_elixhauser	0.00000000	10243638.3
tm1_psychosis_elixhauser	1.96315560	7271596778.6
tm1_pulmcirc_elixhauser	-1.36726800	191460613.0
tm1_pvd_elixhauser	0.45923715	2795376610.2
tm1_renal_elixhauser	-1.67298026	4916314865.9
tm1_uncompdiabetes_elixhauser	-0.55503747	1666629091.2
tm1_valvulardz_elixhauser	5.21795016	3978243885.5
tm1_wtloss_elixhauser	0.00000000	17045649.5
tm1_cerebrovasculardz_romano	-0.21059452	866556816.8
tm1_chf_romano	-0.74011177	1147432653.0
tm1_dementia_romano	-2.37187549	679465301.3
tm1_hemiplegia_romano	2.75428700	813390141.0
tm1_hivaidz_romano	2.01642482	4216644306.3
tm1_metastatic_romano	-1.45290296	4565099010.8
tm1_myocardialinfarct_romano	-1.19836567	1137999521.2
tm1_pulmonarydz_romano	1.45173933	3339394803.1
tm1_tumor_romano	-0.44506041	2811460045.7
tm1_ulcer_romano	-0.14312331	9280264175.1
tm1_cost_dialysis	1.83038548	10713581398.3

## tm1_cost_emergency	-1.34424206	64341447421.9
## tm1_cost_home_health	8.03188545	17878955291.1
## tm1_cost_ip_medical	3.57798568	46917681366.1
## tm1_cost_ip_surgical	2.14709359	6194606180.4
## tm1_cost_laboratory	-0.75461341	98248448174.2
## tm1_cost_op_primary_care	1.57722514	59226673937.3
## tm1_cost_op_specialists	-0.84860348	63510498156.0
## tm1_cost_op_surgery	2.12893210	31732619691.5
## tm1_cost_other	-3.19614120	106434767974.0
## tm1_cost_pharmacy	8.97404143	57166797214.6
## tm1_cost_physical_therapy	-0.08050967	25330222562.0
## tm1_cost_radiology	0.94650383	33189501194.1
## tm1_lasix_dose_count	1.49927543	13068330381.1
## tm1_lasix_min_daily_dose	3.46044506	23595140452.4
## tm1_lasix_mean_daily_dose	1.86643629	23202703500.3
## tm1_lasix_max_daily_dose	2.80946019	16951708773.6
## tm1_cre_tests	2.02607105	14712324217.4
## tm1_crp_tests	0.00000000	86254632.8
## tm1_esr_tests	1.13212613	6788554310.0
## tm1_ghbalt_tests	-0.14659886	5263841105.8
## tm1_hct_tests	1.71550408	35295470699.3
## tm1_ldl_tests	0.18197374	3534904255.5
## tm1_nt_bnp_tests	0.51306262	2987345871.8
## tm1_sodium_tests	-0.21351717	9434794084.4
## tm1_trig_tests	-0.83755710	5177332530.0
## tm1_cre_minlow	-0.42314941	2636265204.5
## tm1_cre_minhigh	-0.64861421	2736355242.3
## tm1_cre_minnormal	-0.86363346	4562061247.0
## tm1_cre_meanlow	-0.30403363	6718715730.2
## tm1_cre_meanhigh	-1.60692319	1530868952.8
## tm1_cre_meannormal	0.25467938	8981555239.2
## tm1_cre_maxlow	0.88066167	3335839435.9
## tm1_cre_maxhigh	-0.84234182	1028609171.5
## tm1_cre_maxnormal	-0.41876240	1432140525.3
## tm1_crp_minlow	0.00000000	12859000.2
## tm1_crp_minhigh	0.00000000	74699806.2
## tm1_crp_minnormal	0.00000000	0.0
## tm1_crp_meanlow	0.00000000	80457928.5
## tm1_crp_meanhigh	0.00000000	76855086.9
## tm1_crp_meannormal	0.00000000	0.0
## tm1_crp_maxlow	0.00000000	45775361.4
## tm1_crp_maxhigh	0.00000000	30305609.6
## tm1_crp_maxnormal	0.00000000	0.0
## tm1_esr_minlow	0.00000000	0.0
## tm1_esr_minhigh	-0.32635459	1003293290.6
## tm1_esr_minnormal	0.24062016	1953261980.3
## tm1_esr_meanlow	0.00000000	0.0
## tm1_esr_meanhigh	-0.63599615	261860616.1
## tm1_esr_meannormal	0.89237340	2476396954.3
## tm1_esr_maxlow	0.00000000	0.0
## tm1_esr_maxhigh	0.31043919	564932546.1
## tm1_esr_maxnormal	-0.42044904	1946814254.0
## tm1_ghbalt_minlow	0.00000000	0.0
## tm1_ghbalt_minhigh	1.13952807	765081238.5

## tm1_ghba1c_minnormal	-0.83360481	1320664894.8
## tm1_ghba1c_meanlow	0.00000000	101150.0
## tm1_ghba1c_meanhigh	-0.22445546	1071305241.7
## tm1_ghba1c_meannormal	1.00539514	1268662937.9
## tm1_ghba1c_maxlow	0.00000000	91875.0
## tm1_ghba1c_maxhigh	1.16298051	837050932.8
## tm1_ghba1c_maxnormal	0.49484631	1878099673.1
## tm1_hct_minlow	4.30900386	3270919939.2
## tm1_hct_minhigh	-1.65442581	260757950.3
## tm1_hct_minnormal	1.82057190	1642685428.8
## tm1_hct_meanlow	-1.85679521	1581771158.1
## tm1_hct_meanhigh	-0.88983456	256540807.4
## tm1_hct_meannormal	1.29062943	1778777898.1
## tm1_hct_maxlow	-1.44129333	4023810752.4
## tm1_hct_maxhigh	-1.14426564	230398385.7
## tm1_hct_maxnormal	1.83297985	1077211422.1
## tm1_ldl_minlow	-1.37757218	456252003.6
## tm1_ldl_minhigh	0.34014407	5790517970.2
## tm1_ldl_minnormal	1.03923782	9685714803.5
## tm1_ldlmeanlow	-0.66596548	1223356849.0
## tm1_ldlmeanhigh	0.83282401	5808657998.2
## tm1_ldlmeannormal	-0.62962130	1566008491.7
## tm1_ldl_maxlow	0.04455153	1006835078.7
## tm1_ldl_maxhigh	0.99258207	6196775374.2
## tm1_ldl_maxnormal	0.13662904	1543742255.6
## tm1_nt_bnp_minlow	0.92455954	159970078.4
## tm1_nt_bnp_minhigh	0.21926591	6481061809.1
## tm1_nt_bnp_minnormal	-1.11471530	667181242.3
## tm1_nt_bnp_meanlow	1.02694400	43071790.2
## tm1_nt_bnp_meanhigh	0.67503133	2148638930.4
## tm1_nt_bnp_meannormal	0.00000000	8229777.0
## tm1_nt_bnp_maxlow	-0.58886280	75653295.7
## tm1_nt_bnp_maxhigh	-0.19571484	3799691439.5
## tm1_nt_bnp_maxnormal	1.00503782	23729195.1
## tm1_sodium_minlow	0.73116753	1010053576.6
## tm1_sodium_minhigh	0.00000000	474164.4
## tm1_sodium_minnormal	1.22266911	1181933638.8
## tm1_sodium_meanlow	1.59332998	1634813428.2
## tm1_sodium_meanhigh	0.00000000	1371675.1
## tm1_sodium_meannormal	1.65209392	1180740900.9
## tm1_sodium_maxlow	-0.60838515	681397776.0
## tm1_sodium_maxhigh	-0.39320357	2379559713.3
## tm1_sodium_maxnormal	1.98912002	1407950592.3
## tm1_trig_minlow	-0.18048928	1910440114.7
## tm1_trig_minhigh	1.70902414	558190157.7
## tm1_trig_minnormal	-1.20021355	6303178547.0
## tm1_trig_meanlow	0.82504079	2477475385.1
## tm1_trig_meanhigh	1.44206140	541784748.4
## tm1_trig_meannormal	-1.22068533	1414246922.4
## tm1_trig_maxlow	-0.42725080	5216872012.5
## tm1_trig_maxhigh	-0.99075721	603035449.4
## tm1_trig_maxnormal	1.50073988	7991894794.6
## tm1_gagne_sum	6.31482534	205183600848.8

mod2



```
## quartz_off_screen
## 3
```

```
## pdf
## 2
```

```
##
## Call:
## randomForest(formula = reformulate(exclude_race, "gagne_sum_t"), data = training, ntree = 100,
##               Type of random forest: regression
##               Number of trees: 100
## No. of variables tried at each split: 149
##
##               Mean of squared residuals: 1.18416
##               % Var explained: 68.91
```

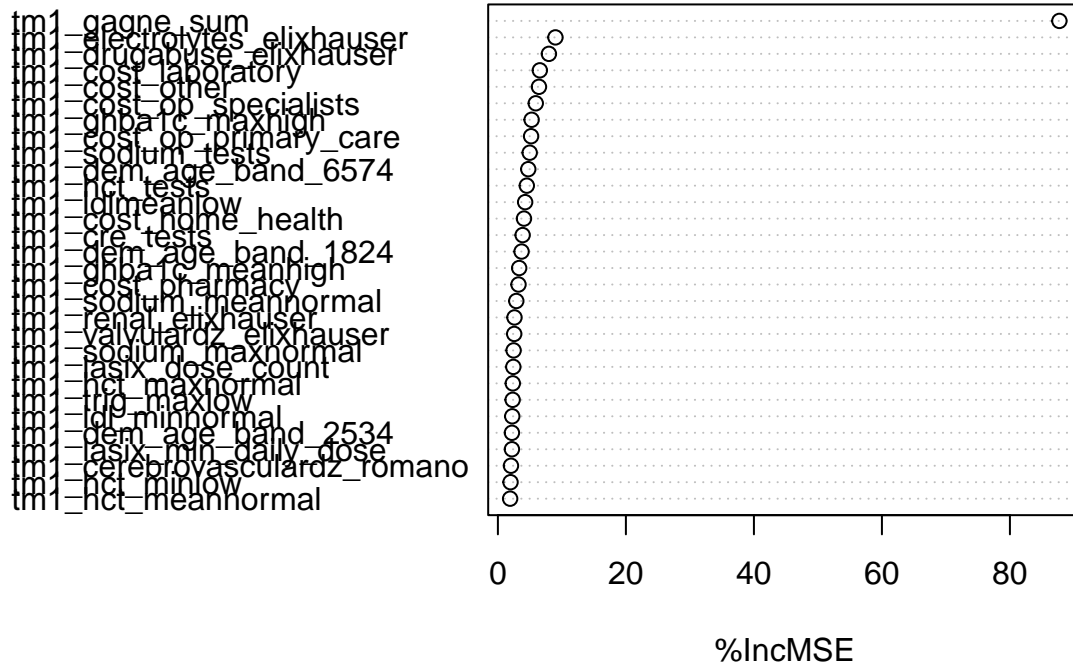
	%IncMSE	IncNodePurity
## tm1_dem_female	0.794167235	42.4796633883175118739928
## tm1_dem_age_band_1824	3.699801884	15.4521263025418722492077
## tm1_dem_age_band_2534	2.190962914	12.4633354486674736705254
## tm1_dem_age_band_3544	1.684520596	32.6317065630287217459227
## tm1_dem_age_band_4554	-1.126995319	20.6642073739639826612802
## tm1_dem_age_band_5564	-1.312295924	30.0070256886099819837455
## tm1_dem_age_band_6574	4.743783660	57.1248526063769261895686
## tm1_dem_age_band_75	0.452967605	40.5422348498267623995162

## tm1_alcohol_elixhauser	-2.873176950	16.2547794811698551598056
## tm1_anemia_elixhauser	-0.811061834	34.1969664289528338940727
## tm1_arrhythmia_elixhauser	0.838697762	20.2470648382945519472287
## tm1_arthritis_elixhauser	-0.881697947	27.3067508136875041202529
## tm1_bloodlossanemia_elixhauser	-1.639328554	9.2110070627652156360909
## tm1_coagulopathy_elixhauser	-2.339981324	11.4791631044223532143178
## tm1_compdiabetes_elixhauser	-2.489608879	19.9744919550522084250588
## tm1_depression_elixhauser	0.554347662	40.4040328612094512550357
## tm1_drugabuse_elixhauser	7.971300580	67.7119425122144349415976
## tm1_electrolytes_elixhauser	8.990249190	22.1942724458086111383182
## tm1_hypertension_elixhauser	1.670590308	28.3213968530527786526818
## tm1_hypothyroid_elixhauser	0.785819368	49.1736228197028140129987
## tm1_liver_elixhauser	-2.226085887	22.6443260544643152343269
## tm1_neurodegen_elixhauser	-2.543399939	23.6230818453196746986578
## tm1_obesity_elixhauser	-0.759054470	34.3325807876726116774080
## tm1_paralysis_elixhauser	0.000000000	0.4847348188848218386582
## tm1_psychosis_elixhauser	-2.071787905	16.4885926343711766151046
## tm1_pulmcirc_elixhauser	-1.019180008	13.5906970473105541685754
## tm1_pvd_elixhauser	-1.283164262	11.6400430968118797636635
## tm1_renal_elixhauser	2.589637232	17.5097301618406682166551
## tm1_uncompdiabetes_elixhauser	-1.004141486	15.8478873136894868878244
## tm1_valvulardz_elixhauser	2.546869625	28.8579420028708497625303
## tm1_wtloss_elixhauser	-1.998265485	2.4955116555279390766486
## tm1_cerebrovascular dz_roman	2.041077348	28.1751275992298495509658
## tm1_chf_roman	-1.437672038	24.0889426692943295904570
## tm1_dementia_roman	0.085757566	16.8991113065731077824694
## tm1_hemiplegia_roman	-1.455617176	1.9281512432841894089108
## tm1_hiv_aids_roman	-1.572337783	16.3318980107389286615671
## tm1_metastatic_roman	-0.539449863	5.8856420463243308560664
## tm1_myocardial_infarct_roman	1.117260640	10.4154147227454227930821
## tm1_pulmonary dz_roman	-2.551525354	35.2937694201533247451152
## tm1_tumor_roman	1.822410649	28.8532582499921232965789
## tm1_ulcer_roman	-2.380951929	15.2591513445422304329213
## tm1_cost_dialysis	-1.273707778	6.3752775302824291614456
## tm1_cost_emergency	-1.857112420	181.9786215414178514038213
## tm1_cost_home_health	4.072787681	97.5292420577577701124028
## tm1_cost_ip_medical	0.435081029	104.4461066898633703203814
## tm1_cost_ip_surgical	0.391071488	64.5361144683167395896817
## tm1_cost_laboratory	6.551120496	352.1481133174452224920969
## tm1_cost_op_primary_care	5.186292755	430.6463118832099894461862
## tm1_cost_op_specialists	5.914313644	317.0458599295359931602434
## tm1_cost_op_surgery	1.480700828	236.5076275733421766744868
## tm1_cost_other	6.415673394	299.9965008516037414665334
## tm1_cost_pharmacy	3.219641323	102.0111335119294579953930
## tm1_cost_physical_therapy	1.643439004	140.3954534119483241738635
## tm1_cost_radiology	1.606965883	212.9388152187553373551054
## tm1_lasix_dose_count	2.409256488	27.6811313797775895295672
## tm1_lasix_min_daily_dose	2.188591413	30.8325401091422719446200
## tm1_lasix_mean_daily_dose	-2.450831180	12.1045056995248234699147
## tm1_lasix_max_daily_dose	-0.966836736	7.6263283826854761926484
## tm1_cre_tests	3.865033999	54.9121422899879263468392
## tm1_crp_tests	0.000000000	0.3255585906655751871064
## tm1_esr_tests	0.722444177	12.5585331825643500280876
## tm1_ghbaltc_tests	0.547584070	53.7856719908763807325158

## tm1_hct_tests	4.514227127	84.0400099649500020859705
## tm1_ldl_tests	1.522718500	38.1086646323625757304399
## tm1_nt_bnp_tests	-1.069834755	18.5854811705876166172402
## tm1_sodium_tests	4.969812666	75.6101671978153291320268
## tm1_trig_tests	0.259775705	55.2769334383472852323393
## tm1_cre_minlow	-0.516738596	11.6218827128736386100627
## tm1_cre_minhigh	-1.829629234	10.9290637501816618737394
## tm1_cre_minnormal	-0.007576191	17.4750900332472554055130
## tm1_cre_meanlow	-0.092659779	17.0580965665442434442411
## tm1_cre_meanhigh	0.162506281	8.6126897216834521486817
## tm1_cre_meannormal	-0.287033933	18.1432052311621418994037
## tm1_cre_maxlow	-0.123182387	8.5236292330598750766057
## tm1_cre_maxhigh	0.462362655	8.3590818088518794581887
## tm1_cre_maxnormal	-1.375244616	31.5104463475918343817739
## tm1_crp_minlow	0.000000000	0.0085714285714288962481
## tm1_crp_minhigh	0.000000000	0.0811677018633548685855
## tm1_crp_minnormal	0.000000000	0.0000000000000000000000
## tm1_crp_meanlow	0.000000000	0.00000000000000017053026
## tm1_crp_meanhigh	0.000000000	0.0000000000000000000000
## tm1_crp_meannormal	0.000000000	0.0000000000000000000000
## tm1_crp_maxlow	0.000000000	0.00000000000000005684342
## tm1_crp_maxhigh	0.000000000	0.4200490336081488806919
## tm1_crp_maxnormal	0.000000000	0.0000000000000000000000
## tm1_esr_minlow	0.000000000	0.0000000000000000000000
## tm1_esr_minhigh	-1.474238146	2.5771022210061009793947
## tm1_esr_minnormal	-1.535934688	5.9180484800929979982698
## tm1_esr_meanlow	0.000000000	0.0000000000000000000000
## tm1_esr_meanhigh	-0.163579532	6.4012297885268534258785
## tm1_esr_meannormal	-2.357776902	7.7971049900467699345086
## tm1_esr_maxlow	0.000000000	0.0000000000000000000000
## tm1_esr_maxhigh	1.036726217	3.1687263223898360919861
## tm1_esr_maxnormal	-0.036647167	8.2980908825208334889112
## tm1_ghbaltc_minlow	0.000000000	0.0355790586991020091334
## tm1_ghbaltc_minhigh	-0.020484836	10.1702316313576144324315
## tm1_ghbaltc_minnormal	1.463073794	18.5410354305553610743118
## tm1_ghbaltc_meanlow	0.000000000	0.1444724224353987618308
## tm1_ghbaltc_meanhigh	3.324879032	10.6572174226286264797636
## tm1_ghbaltc_meannormal	-0.076832081	8.4932300087955390210936
## tm1_ghbaltc_maxlow	0.000000000	0.1106107845642731041247
## tm1_ghbaltc_maxhigh	5.268894908	12.8547794112598960936111
## tm1_ghbaltc_maxnormal	-0.624870096	11.8016637836438107456161
## tm1_hct_minlow	1.975874218	12.2058869113570107600708
## tm1_hct_minhigh	0.826713076	0.3893094568747946238041
## tm1_hct_minnormal	-0.122577561	14.8243619774374124631322
## tm1_hct_meanlow	1.263793763	12.3261818552445561181230
## tm1_hct_meanhigh	-0.656724785	0.6681495822677895324304
## tm1_hct_meannormal	1.913339434	12.8231618357106658123712
## tm1_hct_maxlow	-3.074195323	46.9808705181849362020330
## tm1_hct_maxhigh	-1.507186698	1.6410560371039448757102
## tm1_hct_maxnormal	2.327885866	17.2439119846021142734571
## tm1_ldl_minlow	1.316922617	13.3660815822839023070401
## tm1_ldl_minhigh	1.783876435	17.9033709877011943945035
## tm1_ldl_minnormal	2.241248596	17.3549653033921629230463
## tm1_ldlmeanlow	4.256995557	14.7846817795189799937816

## tml_ldlmeanhigh	1.209436873	11.5621489405814319439969
## tml_ldlmeannormal	-0.538080250	9.7704003661740213004805
## tml_ldl_maxlow	-0.131831496	14.5446872989740949577708
## tml_ldl_maxhigh	0.141743643	12.7199434841921235062046
## tml_ldl_maxnormal	-1.074826314	15.0289010187742615443085
## tml_nt_bnp_minlow	0.917800398	4.9123674818378129103280
## tml_nt_bnp_minhigh	1.203856943	2.3346347699836811351304
## tml_nt_bnp_minnormal	0.683952425	0.6047720431608700764059
## tml_nt_bnp_meanlow	-1.557216747	3.2320548435060914016503
## tml_nt_bnp_meanhigh	0.613057225	2.2957603755764806052753
## tml_nt_bnp_meannormal	-0.542813274	2.1306229655050192839383
## tml_nt_bnp_maxlow	0.144874249	3.5478683030142161847209
## tml_nt_bnp_maxhigh	0.384799234	3.2816229163304053706440
## tml_nt_bnp_maxnormal	-0.360318157	5.3280247013073722683885
## tml_sodium_minlow	0.819108665	12.1298786871755730487621
## tml_sodium_minhigh	0.000000000	0.5664393939393932431159
## tml_sodium_minnormal	0.127943246	10.2083131528917245844923
## tml_sodium_meanlow	-1.284443668	8.7860348567911739081637
## tml_sodium_meanhigh	0.000000000	0.1152433862433872441278
## tml_sodium_meannormal	2.875014011	12.5296373096761097798435
## tml_sodium_maxlow	-0.907950489	7.2363386053739198189305
## tml_sodium_maxhigh	-2.118670506	7.2105240872694480458449
## tml_sodium_maxnormal	2.454899673	8.0146767724915211061898
## tml_trig_minlow	-0.785700703	10.5447809464322492800648
## tml_trig_minhigh	1.876396107	17.8605879289003510734801
## tml_trig_minnormal	-0.144473807	10.5685337382747839285457
## tml_trig_meanlow	-0.396246420	6.0464674634410195963596
## tml_trig_meanhigh	0.693276763	10.7798766296007144660507
## tml_trig_meannormal	1.427473711	9.0604109879999867871447
## tml_trig_maxlow	2.304153108	8.7524065604142577967650
## tml_trig_maxhigh	1.165103657	9.0109996717990661352360
## tml_trig_maxnormal	0.998037643	11.8095601281247972735855
## tml_gagne_sum	87.729767542	13596.5777082057575171347708

mod3



```
## quartz_off_screen
## 3
```

```
## pdf
## 2
```

```
##
## Call:
## randomForest(formula = reformulate(all_predictors, "gagne_sum_t"), data = training, ntree = 100,
##               Type of random forest: regression
##               Number of trees: 100
## No. of variables tried at each split: 150
##
##               Mean of squared residuals: 1.169171
##               % Var explained: 69.3
```

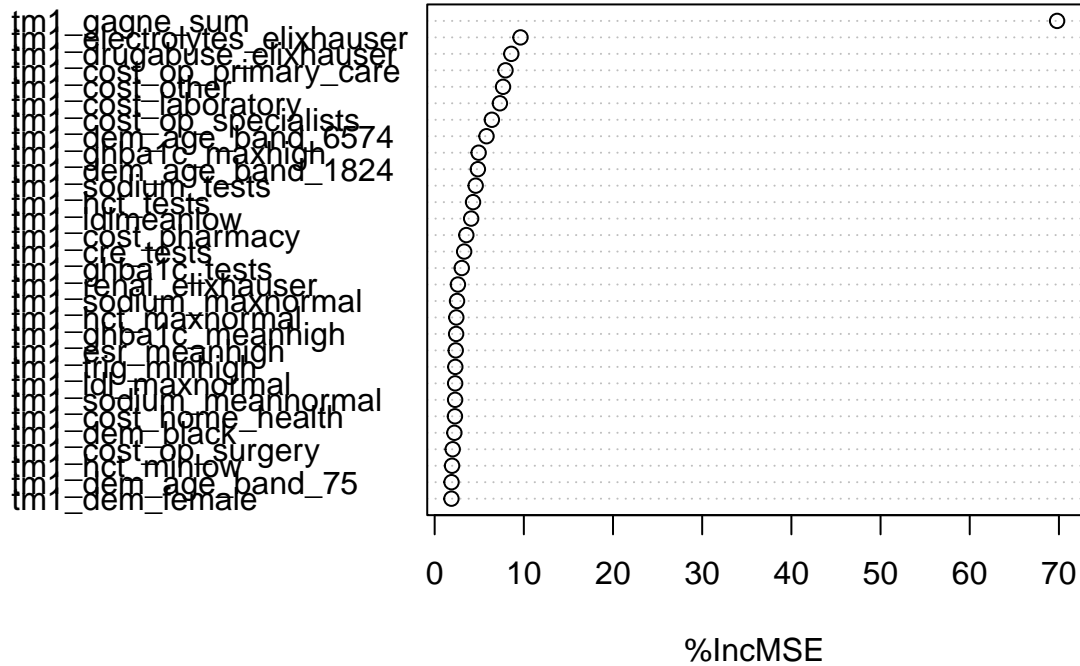
	%IncMSE	IncNodePurity
## tm1_dem_black	2.20967866	41.9461155495456665676102
## tm1_dem_female	1.88202320	42.1386625494201680908191
## tm1_dem_age_band_1824	4.84366982	15.1989189049729809255496
## tm1_dem_age_band_2534	1.42055518	14.3255514541063782019137
## tm1_dem_age_band_3544	1.41312545	33.2546258024175571677006
## tm1_dem_age_band_4554	-1.26982836	21.7508108871209522305890
## tm1_dem_age_band_5564	-0.79880167	25.9448052543064129338291
## tm1_dem_age_band_6574	5.81277274	51.2673069611464526929012

## tm1_dem_age_band_75	1.89072363	44.2272240508442635587016
## tm1_alcohol_elixhauser	-1.92227783	18.1257341698035965293911
## tm1_anemia_elixhauser	-2.61470369	33.4779446137953087259120
## tm1_arrhythmia_elixhauser	1.34649201	19.2734074931112466799732
## tm1_arthritis_elixhauser	-0.23126511	30.8026639361604743783118
## tm1_bloodlossanemia_elixhauser	-1.51152536	6.3915651646958471232551
## tm1_coagulopathy_elixhauser	-1.64945212	15.1120158842821687983360
## tm1_compdiabetes_elixhauser	-2.02089915	23.1854325435543415778739
## tm1_depression_elixhauser	-0.72953877	37.9130502967365998756577
## tm1_drugabuse_elixhauser	8.59605645	56.7624701226080574656407
## tm1_electrolytes_elixhauser	9.62678577	22.9202635857368939298340
## tm1_hypertension_elixhauser	1.63304994	29.4074898564168023540333
## tm1_hypothyroid_elixhauser	0.26479521	51.0014410833332476613577
## tm1_liver_elixhauser	-3.22397699	20.3549893609492755786050
## tm1_neurodegen_elixhauser	-1.93562932	27.1492097868184494302568
## tm1_obesity_elixhauser	0.42937112	34.9928591304769724956714
## tm1_paralysis_elixhauser	0.00000000	0.2127659574468134529024
## tm1_psychosis_elixhauser	-1.19493469	17.6431392027737352634631
## tm1_pulmcirc_elixhauser	0.04951919	13.2145174768821949129460
## tm1_pvd_elixhauser	-0.38039135	14.2785837851435992718052
## tm1_renal_elixhauser	2.60717583	15.1300635214505287962083
## tm1_uncompdiabetes_elixhauser	0.77447337	14.3134205817616653177993
## tm1_valvulardz_elixhauser	1.34057405	31.5513484308895009178286
## tm1_wtloss_elixhauser	-1.97214099	2.3547990514711232279410
## tm1_cerebrovasculardz_romano	0.64096355	28.8737632072160508300840
## tm1_chf_romano	-1.75639618	30.3922069837526862556842
## tm1_dementia_romano	-0.35581282	19.4737729626092495038847
## tm1_hemiplegia_romano	-1.73386413	1.8497025748607323070161
## tm1_hivaidz_romano	-1.14328736	14.3371221977264422520193
## tm1_metastatic_romano	-0.14955340	8.2241095250067584032649
## tm1_myocardialinfarct_romano	-1.60405331	12.5417734402521094949634
## tm1_pulmonarydz_romano	-1.77384124	32.9799036117178019367202
## tm1_tumor_romano	1.39865157	33.1825872117221791768316
## tm1_ulcer_romano	-2.91577360	17.1638679904657749375474
## tm1_cost_dialysis	-1.67807060	8.7461734059575046984492
## tm1_cost_emergency	-0.37104881	181.4197839637276672419830
## tm1_cost_home_health	2.27473547	117.5712136775994309800808
## tm1_cost_ip_medical	1.79643977	102.8504070382315376264160
## tm1_cost_ip_surgical	1.29733217	63.3043636226241659414882
## tm1_cost_laboratory	7.31612368	351.2033284685939520386455
## tm1_cost_op_primary_care	7.94280885	398.2226640369856340839760
## tm1_cost_op_specialists	6.41574096	334.2891778912203903928457
## tm1_cost_op_surgery	2.02094003	234.5691752350961110096250
## tm1_cost_other	7.66699575	304.0909953400128529210633
## tm1_cost_pharmacy	3.55046328	88.9899444360896296757346
## tm1_cost_physical_therapy	1.80818970	153.2094758678278765273717
## tm1_cost_radiology	1.65416161	213.5625130831692501942598
## tm1_lasix_dose_count	0.67964397	31.0935697279090526023992
## tm1_lasix_min_daily_dose	1.41747159	28.0888222007149295222916
## tm1_lasix_mean_daily_dose	-1.93281365	10.9482466128331097365844
## tm1_lasix_max_daily_dose	-0.73640777	5.2921233977018689031979
## tm1_cre_tests	3.30932543	51.8384564887354812867670
## tm1_crp_tests	0.00000000	0.00000000000000017053026
## tm1_esr_tests	-1.15637936	14.1735825443840077753066

## tm1_ghba1c_tests	3.04030317	54.0684256167990469066353
## tm1_hct_tests	4.30319376	77.2166131924190750623893
## tm1_ldl_tests	1.70046534	38.7281754531628905624530
## tm1_nt_bnp_tests	0.81428081	16.3552405980956621078803
## tm1_sodium_tests	4.60099448	77.4918728806628678285051
## tm1_trig_tests	1.28894380	49.2487708480696184665248
## tm1_cre_minlow	1.40736266	12.9541118673353370382983
## tm1_cre_minhigh	-0.64770614	11.7493444336069963185309
## tm1_cre_minnormal	-0.99322830	17.4081315246254995088293
## tm1_cre_meanlow	-0.47121092	13.9185671286215590924940
## tm1_cre_meanhigh	-1.35124711	7.0361640870626445121161
## tm1_cre_meannormal	1.27876902	19.1166509822311425637054
## tm1_cre_maxlow	-1.70026156	11.9755297722641920188380
## tm1_cre_maxhigh	1.27595457	10.2096936846711550117561
## tm1_cre_maxnormal	0.35419603	29.3008073532216393175531
## tm1_crp_minlow	0.00000000	0.00000000000000019895197
## tm1_crp_minhigh	0.00000000	0.4144623354985925156591
## tm1_crp_minnormal	0.00000000	0.0000000000000000000000
## tm1_crp_meanlow	0.00000000	0.0000000000000000000000
## tm1_crp_meanhigh	0.00000000	0.1516418170940494192234
## tm1_crp_meannormal	0.00000000	0.0000000000000000000000
## tm1_crp_maxlow	0.00000000	0.00000000000000002842171
## tm1_crp_maxhigh	0.00000000	0.4436999723034813492006
## tm1_crp_maxnormal	0.00000000	0.0000000000000000000000
## tm1_esr_minlow	0.00000000	0.0000000000000000000000
## tm1_esr_minhigh	-1.73903728	3.9022314989649684591200
## tm1_esr_minnormal	1.04907307	6.0058699461303515221289
## tm1_esr_meanlow	0.00000000	0.0000000000000000000000
## tm1_esr_meanhigh	2.36344292	7.6251403023428441230180
## tm1_esr_meannormal	-0.70126005	5.2653465347729868639703
## tm1_esr_maxlow	0.00000000	0.0000000000000000000000
## tm1_esr_maxhigh	0.07168588	3.8093368574785104740954
## tm1_esr_maxnormal	1.21913169	7.7799680464691434167435
## tm1_ghba1c_minlow	0.00000000	0.0354374307862667589641
## tm1_ghba1c_minhigh	1.45011093	11.3093793068829526760055
## tm1_ghba1c_minnormal	0.81547581	21.9105389068401201768665
## tm1_ghba1c_meanlow	0.00000000	0.1065482796892331385230
## tm1_ghba1c_meanhigh	2.40748770	9.8466079253391516346028
## tm1_ghba1c_meannormal	1.05850112	14.3603460236769659985612
## tm1_ghba1c_maxlow	0.00000000	0.0692196878751519806272
## tm1_ghba1c_maxhigh	4.93201744	13.5367720214504974052261
## tm1_ghba1c_maxnormal	-0.63547054	13.6350689311403350245655
## tm1_hct_minlow	1.94890449	16.2622538988544960147919
## tm1_hct_minhigh	0.89962322	1.1579014831503655624800
## tm1_hct_minnormal	1.17015037	10.9010409019277432207673
## tm1_hct_meanlow	1.04384894	9.8689205503479584535853
## tm1_hct_meanhigh	1.28459423	0.7553373255402852093354
## tm1_hct_meannormal	-0.56249675	12.1169437526267955718140
## tm1_hct_maxlow	-2.76359269	33.8319096232449965100386
## tm1_hct_maxhigh	-2.12044858	2.7596087858211162391342
## tm1_hct_maxnormal	2.42783322	12.6534151962919807488106
## tm1_ldl_minlow	0.60038869	11.6368446989588285589434
## tm1_ldl_minhigh	1.33469655	13.3753549635645256898897
## tm1_ldl_minnormal	0.78882136	16.3892343914942273386259

## tm1_ldlmeanlow	4.09335177	13.8856875355360216417466
## tm1_ldlmeanhigh	0.08729881	8.4307452112229412932720
## tm1_ldlmeannormal	1.24016930	10.3303884534967451713783
## tm1_ldl_maxlow	1.72912115	13.4937250075500827506403
## tm1_ldl_maxhigh	1.44486754	12.9291357693226149905286
## tm1_ldl_maxnormal	2.29760538	15.2269556678726623033526
## tm1_nt_bnp_minlow	-1.10752508	6.3620777587128829466678
## tm1_nt_bnp_minhigh	1.79548009	2.3805616999053129667629
## tm1_nt_bnp_minnormal	0.34086113	1.1079565972313158983553
## tm1_nt_bnp_meanlow	-1.98700561	4.6990006460556807965645
## tm1_nt_bnp_meanhigh	0.65550899	1.1819919930677995623114
## tm1_nt_bnp_meannormal	0.00000000	0.6950982936279035406812
## tm1_nt_bnp_maxlow	-1.90840479	4.1883220233396079024146
## tm1_nt_bnp_maxhigh	1.27732635	4.8685760996890534713089
## tm1_nt_bnp_maxnormal	0.00000000	4.4115093423207669687258
## tm1_sodium_minlow	-0.18401851	15.5314503456342407616830
## tm1_sodium_minhigh	0.00000000	0.1916366300366324770810
## tm1_sodium_minnormal	0.50491523	9.0212064938817633219514
## tm1_sodium_meanlow	-1.99811366	10.8442415688857867195338
## tm1_sodium_meanhigh	0.00000000	0.3042871069303133557682
## tm1_sodium_meannormal	2.29329666	9.3705330422617389984907
## tm1_sodium_maxlow	-2.49434715	6.8742011199689940781354
## tm1_sodium_maxhigh	-2.06710174	6.3711821381216511284151
## tm1_sodium_maxnormal	2.50999071	11.0732832196672195124165
## tm1_trig_minlow	-0.36369090	8.7131129892762366750958
## tm1_trig_minhigh	2.31499482	12.7756190501206212672969
## tm1_trig_minnormal	0.73588689	7.7770042962759022842079
## tm1_trig_meanlow	0.46487201	4.9349415748069231923978
## tm1_trig_meanhigh	-0.87670450	10.5850449035814992981841
## tm1_trig_meannormal	0.88372139	8.9434411305149712489992
## tm1_trig_maxlow	1.33924598	8.4772501249165301828725
## tm1_trig_maxhigh	-0.51365786	9.7972404286998830968969
## tm1_trig_maxnormal	1.02072936	11.2178214888749838706872
## tm1_gagne_sum	69.79954417	13527.9908311986546323169023

mod4



```
## quartz_off_screen
## 3
```

```
## pdf
## 2
```

Question 3

```
##          algorithm      RMSPE
## 1 Model 1 - Costs (excl. race) 7552.5646837
## 2 Model 2 - Costs (incl. race) 7417.0943743
## 3 Model 3 - Health (excl. race)  0.4746778
## 4 Model 4 - Health (incl. race)  0.4681662
```

Question 4

```
#-----
# Calculate and compare the mean squared error in the lock box data
#-----

## Root mean squared prediction error in the test sample.
p <- 4
```



```

RMSPE_OOS <- matrix(0, p, 1)

## Model 1
RMSPE_OOS[1] <- sqrt(mean((test$cost_t - y_test_predictions_mod1)^2, na.rm=TRUE))

## Model 2
RMSPE_OOS[2] <- sqrt(mean((test$cost_t - y_test_predictions_mod2)^2, na.rm=TRUE))

## Model 3
RMSPE_OOS[3] <- sqrt(mean((test$gagne_sum_t - y_test_predictions_mod3)^2, na.rm=TRUE))

## Model 4
RMSPE_OOS[4] <- sqrt(mean((test$gagne_sum_t - y_test_predictions_mod4)^2, na.rm=TRUE))

#Display a table of the results
data.frame(algorithm = c("Model 1 - Costs (excl. race) ",
                        "Model 2 - Costs (incl. race) ",
                        "Model 3 - Health (excl. race)",
                        "Model 4 - Health (incl. race)"),
           RMSPE_OOS)

```

```

##           algorithm      RMSPE_OOS
## 1 Model 1 - Costs (excl. race) 16464.052563
## 2 Model 2 - Costs (incl. race) 16480.923020
## 3 Model 3 - Health (excl. race)    1.071303
## 4 Model 4 - Health (incl. race)    1.069759

```